

July 2002  
16GW-0502A-WWEN

Prepared by Network Storage  
Solutions and HP Services

Compaq Computer Corporation

### Contents

<b>1.0 Solution Description.....</b>	<b>3</b>
1.1 Solution Components.....	5
<b>2.0 Business Value .....</b>	<b>8</b>
2.1 Features and Benefits .....	9
2.2 Customer Profile.....	11
2.3 Application Best Fits.....	11
<b>3.0 Installing, Configuring, and   Managing SAN and NAS   Components .....</b>	<b>12</b>
3.1 Installing the MA8000/EMA12000 .....	12
3.2 Cabling and Configuring the Fibre Channel Switches .....	12
3.3 Configuring the SAN Management Appliance.....	13
3.4 Configuring NAS Executor E7000 .....	20
3.5 Managing Storage on the Integrated NAS and SAN .....	23
3.6 Configuring the Enterprise Backup Solution .....	26
<b>4.0 Working with HP Services .....</b>	<b>28</b>
<b>5.0 Related Information .....</b>	<b>28</b>
5.1 Related Documents.....	28
5.2 Related Websites .....	29

# Scalable Reference SAN with NAS Configuration

### *Abstract*

Customers need to understand how SAN (storage area network) and NAS (network attached storage) technologies can be used together to complement and optimize the way they use storage. The Scalable Reference SAN with NAS solution describes a configuration that incorporates a SAN to handle data management, data performance, and scalability tasks with a NAS file server for data sharing between multiple operating systems.

Scalable Reference SAN with NAS provides the following advantages:

- A SAN with support for heterogeneous servers, high availability, and sophisticated data protection including snapshots, clones, and remote data mirroring.
- A NAS file server that serves data to multiple users and that acts as a gateway, bringing the benefits of the SAN's highly available and reliable storage to systems not directly connected to the fibre channel infrastructure.
- Centralized management, which allows customers to significantly decrease the effort required to manage their storage infrastructure.

The intended audience is made up of IT administrators, who know basic administrative procedures and file-sharing protocols for server, network installations, and SAN administration.

## Notice

©2002 Compaq Information Technologies Group, L.P.

Compaq, the Compaq logo, StorageWorks, and SANworks are trademarks of Compaq Information Technologies Group, L.P., in the U.S. and/or other countries.

Microsoft, MS-DOS, Windows, and Windows NT are trademarks of Microsoft Corporation in the U.S. and/or other countries.

UNIX is a trademark of The Open Group in the U.S. and/or other countries.

All other product names mentioned herein may be trademarks in their respective countries.

Note: In order to continually provide improved features and functions, the hardware and software products used in this solution are subject to change. Although it is our objective that all newly released products be compatible with previously released solutions, Compaq makes no warranty of compatibility of any kind. As always, it remains the responsibility of the user to refer to the specific component documentation when applying component versions that do not match those stated in this section.

Scalable Reference SAN with NAS Configuration  
Solution Guide prepared by Network Storage Solutions and HP Services.

First Edition June 2002  
Part Number 16GW-0502A-WWEN

## 1.0 Solution Description

The Scalable Reference SAN with NAS solution describes how to configure a network with a SAN to handle management, performance and scalability along with a NAS file server for high availability and file sharing between multiple operating systems. The demand for storage capacity continues to surge today, fueled by the growth of the Internet and a rising demand for online access to data. The ability to move and access data has become a mission-critical capability for every enterprise. And the business pressure is immense -- both to improve data management while reducing Total Cost of Ownership (TCO) and increasing Return On Investment (ROI).

Storage networking, including SAN and NAS technology, is essential in mission-critical IT environments and is the dominant trend in data storage. Gartner, Inc. estimates that customer expenditures on storage networking solutions will exceed \$65 billion in 2003.

The significant question is how to get the greatest return from a major investment in both storage network architectures. The Scalable Reference SAN with NAS uses leading open technology, including support for heterogeneous servers, high availability, and sophisticated backup and restore techniques. By incorporating a NAS file server, the configuration extends the benefits of SAN storage to servers and workstations outside of the typical datacenter environment.

In addition, transitioning and migrating from old technology to new technology is often disruptive. To minimize this disruption, you can review this fully integrated and tested approach for implementing a converged SAN/NAS environment. The Scalable Reference SAN with NAS configuration adds three significant capabilities to corporate network architectures:

- Shared storage pools that can scale seamlessly
- Reduced backup and restore times that leverage online archives and new types of secondary storage media.
- Easier management of data, because databases can be controlled from a single central point located anywhere within the NAS or SAN environment.

The combination of these factors including scalability, backup and fast recovery, and manageability demonstrate reduced TCO of cross-enterprise data storage for today's marketplaces.

The Scalable Reference SAN with NAS solution also supports the Compaq Universal Network Storage initiative, using storage convergence technologies. IT managers and administrators can manage a single storage infrastructure, independent of the physical disk drives, associated disk arrays, or network topology.

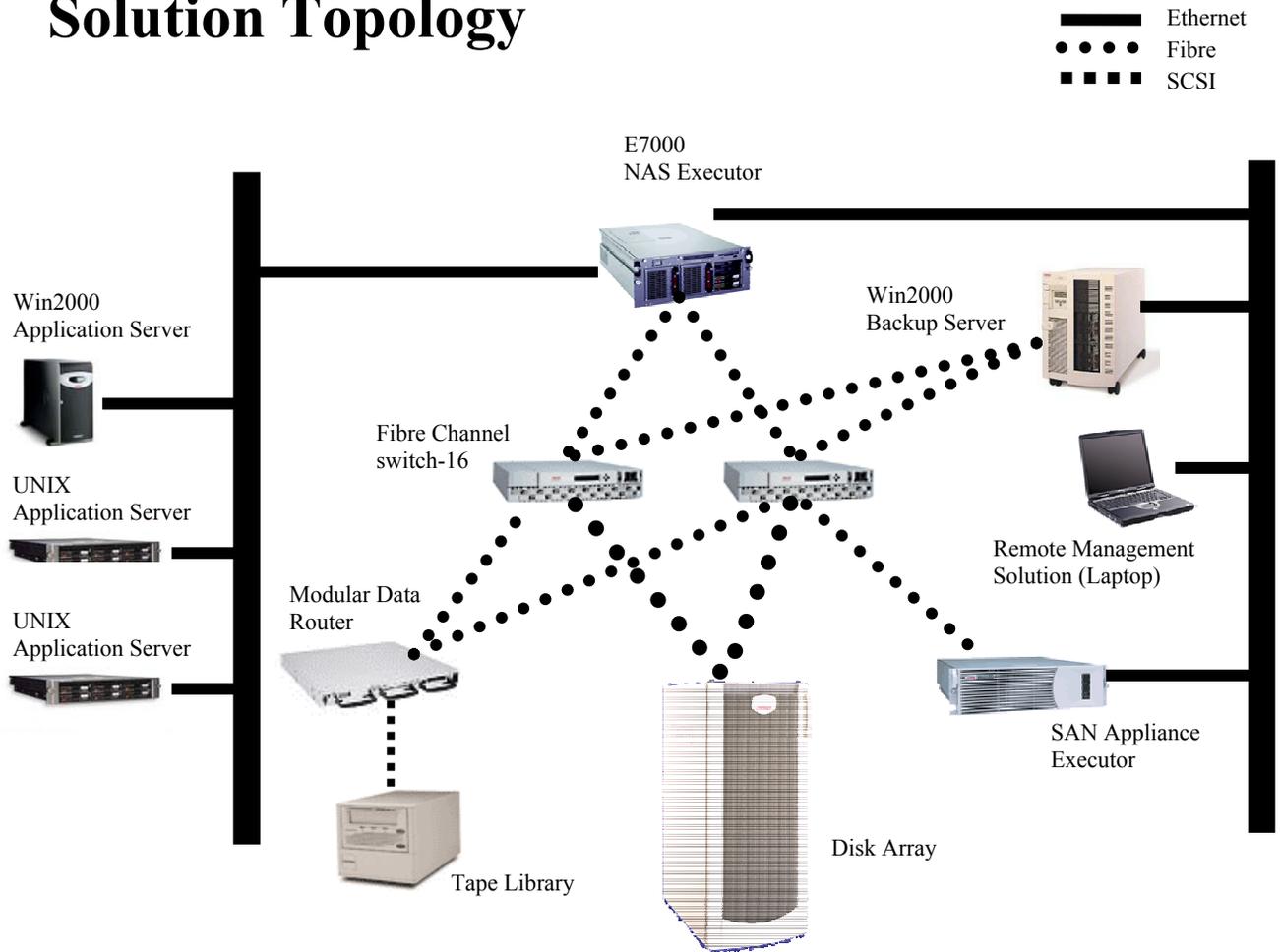
This solution provides an enhanced, integrated infrastructure that solves the major operational issues of unpredictable growth, storage utilization efficiency, and the need for integrity of shared data. Using the information supplied within this guide, IT managers can implement the necessary components and best practices within their existing infrastructure, for as little as the cost of the software licenses.

Procedures for installation, configuration, integration, and operation of the solution components within a typical application environment are included for a smooth and predictable deployment experience.

This guide includes the following solution-specific information:

- Solution description
- Detailed list of hardware and software components
- Features and benefits
- Installation, configuration, and management guidelines

# Solution Topology



**Figure 1: Solution Topology**

## 1.1 Solution Components

The Scalable Reference SAN with NAS solution includes a configuration of hardware, operating system, and storage software components. This configuration is one example of combining NAS and SAN technology. Since SANs are designed to support your specific business requirements, this guide only describes this specific reference SAN.

The diagram above, Figure 1, presents a typical solution configuration. Keep in mind, though, that you can modify the disk array configuration to meet specific application requirements. And you can also modify the tape library backup configuration to meet business requirements. The Storage Area Network configuration, although it can be configured to improve I/O performance, is a recommended core requirement for successful use of this solution.

The Scalable Reference SAN with NAS configuration includes the following required components:

- Storage subsystem
- SAN management appliance
- NAS device that is compatible with storage subsystem
- Fibre channel infrastructure

## **Hardware Components**

Here is a detailed list of hardware components used in the Scalable Reference SAN with NAS configuration:

- ***StorageWorks™* HSG80 by Compaq array controller or *StorageWorks™* HSV110 array controller**  
The solution configuration can operate using direct attached storage and any array controller. You can use any controller but this configuration used the HSG80. All disk storage devices on the network may be considered part of the available storage pool and may be used to create virtual disks. The solution can operate with multiple storage devices, as long as they are available to the specific application and to the backup and management hosts. Existing disk storage may be utilized without any modifications.
- **Management Appliance**  
This component provides a centralized point for managing and monitoring SAN elements, including switches and storage arrays, to simplify management tasks and reduce management costs. Together with Network View, Storage Allocation Reporter, and Resource Manager software, the Management Appliance offers a comprehensive and cost-effective monitoring and storage allocation reporting solution for the multiple platform SAN.
- ***StorageWorks™* NAS Executor E7000 by Compaq**  
This enterprise-class NAS component provides scalability, continuous data availability, and brings SAN level management capability into the NAS file serving space. The NAS Executor E7000 provides heterogeneous file serving capabilities (CIFS, NFS, NCP and MAC), performance optimized for file serving and storage consolidation, mission-critical levels of availability and uptime provided with an NSPoF (no single point of failure) configuration. It also provides clustering support, hardware redundancy, host-based file replication, and includes Virtual Replicator V2.5 for server-based virtualization.
- **Compaq 16 port SAN switches**  
These 16 port switches support new Universal ports, which self-configure to the type of device attached to them and automatically detect a fabric-attached device, a switch-to-switch connection, or an arbitrated loop attached device. They use a common power supply and can also be configured with redundant power supplies.
- **Tape library**  
A tape library and suitable backup software configuration is highly recommended for data backup.
- **Modular Data Router**  
The MDR is a 1U Fibre Channel-to-SCSI bridge that allows multiple host servers to

communicate with a differential (or SE) SCSI tape device (both LVD and HVD) over a Fibre Channel link. Four basic models offer a combination of single or dual FC inputs and either dual or quad SCSI port output modules with a choice of LVD or HVD signaling.

## **Software Components**

Here is a detailed list of software components used in the Scalable Reference SAN with NAS configuration:

- **Open SAN Manager**

Open SAN Manager is the industry's first centralized, appliance-based monitoring and management interface for the Open SAN. Included with the Management Appliance II, Open SAN Manager provides a Web-based aggregation and entry point for centralized storage management. This interface allows the user to organize, visualize, configure, and monitor storage from a single navigation point on the SAN. Open SAN Manager provides a launch site for a variety of value-added applications, and provides navigation links to directly manage storage components on the SAN.

Residing on the Management Appliance, the Resource Manager provides SAN monitoring information and allows for a variety of event notification options. The Resource Manager contains the Element Managers for the HSG80 and HSV110 arrays that enable you to configure, monitor and manage the storage systems contained in the SAN.

- **Storage Allocation Reporter**

Storage Allocation Reporter is a Web-based application used to report and bill storage and associated Quality Of Service reserved by end users in a SAN environment. Storage Allocation Manager automatically provides reporting and billing of allocated LUN capacity from RAID-level storage subsystems while tracking levels of service.

- **Network View**

This SAN management application provides a consolidation point for storage network visualization, monitoring, and configuration. SAN devices, Fibre Channel interconnects, and associated status are automatically discovered and represented in a topographical display.

- **Virtual Replicator V2.5**

Virtual Replicator enables server-based virtualization that provides flexible and simplified storage management for Windows NT and Windows 2000 environments. Users can pool physical storage and create large size virtual disks tailored to the requirements of their production environment. Virtual disk space can be allocated as needed, allowing customers to respond quickly to changing storage capacity requirements. Through virtualization, online volume growth, snapshot and management features, the software complements the standard capabilities within the operating system. By utilizing industry-standard server, storage, and network-interconnect components, an organization's current and future storage investments are protected.

- **Secure Path V3.1A for Windows 2000**

Secure Path V3.1A is included in the NAS image. Secure Path is multipath, high-availability software that manages and maintains continuous data access and fault-

redundant paths to storage systems. For systems connected to the HSV110 or the HGS80 storage controllers, Secure Path also balances the workload between available paths to optimize system performance

- ***StorageWorks™ Enterprise Backup Solution by Compaq***  
Enterprise Backup Solution (EBS) provides a consolidated backup of multiple servers over a high-speed, independent Fibre Channel storage network to centrally attached SCSI tape libraries. EBS fits both low-cost entry-level SAN requirements as well as high-performance SANs in heterogeneous environments.

EBS for low-cost entry level SANs is a Fibre Channel solution for Compaq *ProLiant™* or x86 servers in Windows NT/2000 and NetWare environments. This offering provides data protection that shrinks backup windows and reduces management costs. It also provides the option of configuring a backup solution with either a Fibre Channel hub or a Fibre Channel Arbitrated Loop switch.

EBS for High Performance heterogeneous SANs is a Fibre Channel backup and restore solution that leverages Fibre Channel switches and offers customers a SAN solution, with primary and secondary storage on the same Fibre Channel domain. It allows multiple Windows NT/2000, NetWare, Tru64 UNIX, IBM AIX, Linux, and/or Sun Solaris servers, attached to a Fibre Channel switch, to share a SCSI SDLT or DLT Library or AIT Library.

## 2.0 Business Value

Customers typically base their decisions on SAN or NAS implementations by selecting file or block formats and by determining the hardware and software components they need. But with the Scalable Reference SAN with NAS configuration, the decision to use NAS or SAN systems is irrelevant. The customer benefits are significant and include the following

- Maximize the use of all available storage
- Leverage a central pool of storage resources
- Centralize storage management to reduce operating costs

## 2.1 Features and Benefits

Feature	Impact	Benefit
The decision to use NAS or SAN systems is irrelevant because customer can use both	Fully integrated, converged storage architectures	Ease of choice Eliminates technical trade-offs Easy to implement and grow
Supports multiple operating systems	Allows centralized data and increases flexible storage capacity and efficiency  Data can be shared across multiple operating systems regardless of the device or operating system	Provides strategic power in the marketplace and consolidates data
Storage networks integrate with existing hardware	Less interruption to production systems and easier to manage	Reduces Total Cost of Ownership (TCO)
Enterprise-wide file sharing reduces file duplication	The right information to the right person at the right time in the right format	Data sharing, which reduces storage capacity requirements
Reliable and efficient access to data and application information 24x7	Improves both local and wide-area data retrieval	Improved data availability across the enterprise
Seamless integration of storage devices and architecture	New applications integrate reliably to ensure new data does not overload your system	Faster time to market Lower maintenance costs
Data storage in centrally managed locations rather than across multiple application servers	Facilitates administration, backup, and security	Centralized deployment of specialized resources and skill sets
Storage resources shared among a much larger number of processing systems and users	Improved efficiency and simplified management	Better asset allocation
Data is highly accessible	Business continues without interruption	Provides strategic power in the marketplace

## ***The Benefits of SAN/NAS***

Networked storage drastically reduces the cost of IT staffing. Storage management consumes about 55 percent of the overall storage budget in a distributed environment. By comparison, SANs reduce the percentage to between 15 and 20 percent of the overall budget. The Scalable Reference SAN with NAS devices are even easier to manage because they simply plug into the network and focus on specific file serving needs. Easy-to-use management software tools further facilitate storage administration.

### **NAS Advantages**

- **Easy to add.** The customer can add a NAS Executor to the network within minutes without suspending LAN activity.
- **Reduces the work of the network server.** NAS devices increase storage-on-the-fly capabilities, which the customer can use to redirect network traffic without adding more network nodes. Enterprise managers can offload high-bandwidth, file-serving tasks from the network server, which in turn reduces latency. NAS flexibility lets you add storage wherever you need it, even to remote locations, and also lets the customer perform backups without affecting network server performance.
- **Facilitates data sharing.** NAS devices can connect to multiple operating systems and share data between disparate clients and servers. This solution supports the Network File System (NFS) protocol for UNIX, NetWare Core Protocol (NCP) for Novell, AppleTalk protocol for Macintosh, and the Common Internet File System (CIFS) for Microsoft, which facilitate data sharing between different operating systems.

### **SAN Advantages**

- **Consolidates information.** Can consolidate a huge amount of information into a centralized storage network. The SAN connects all the storage and offloads the network traffic associated with storage access onto the separate network. This translates into lower latency and more efficient resource utilization.
- **Faster data retrieval.** When using Enterprise Virtual Arrays, the SAN is based on a Fibre Channel that uses an arbitrated loop, which provides true 100 MB/s data speeds. The customer obtains significantly faster data speeds when compared with the older SCSI technology, which provides speeds of 40 to 80 MB/s.
- **Easier backup and recovery.** SANs make it easier for companies to implement backup and restore procedures. Data can be mirrored to a remote location for seamless disaster recovery or backed up quickly to another location without affecting network speeds. The customer can save gigabytes of data in a matter of hours, instead of days. In addition, the SAN provides a variety of techniques such as fault redundant paths, clustering, failover, mirroring, and replication, all of which protect against data loss.
- **Exceptional scalability.** A SAN, with its almost unlimited scalability, is an outstanding choice for IT networks, which grow quickly or have sporadic needs for higher storage capacity levels. With management tools, network administrators can reallocate storage space from one server to another by repartitioning the SAN and by assigning storage space to a network server instead of directly connecting to a network server.

## 2.2 Customer Profile

This solution can be implemented in any environment where SAN/NAS consolidation is a key strategic goal for IT operations. Although this solution was tested specifically on Compaq ProLiant servers and *StorageWorks* SAN based storage hardware, you can implement the solution in any open systems environment where the recommended *SANworks* storage application software is supported.

The solution is targeted toward medium-size businesses, which require improved access to data, simplified management of rapidly growing databases, and quick recovery from data corruption or frequently lost files. This solution also works well for enterprise-class environments that need to integrate the transfer of file-level data. The solution also offers high value to those IT organizations that are implementing entry level or departmental level array based SANs and also want to start building a foundation for storage virtualization. In particular, the solution is aimed at the following types of customers:

- IT managers or executives who have decision making authority for storage solutions, and business managers who are acquiring large application solutions, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM), where storage is a key component to the infrastructure.
- Customers who foresee a rapid growth in the need for more storage capacity but want to acquire the storage incrementally. Many of these customers are small and medium-size businesses that are experiencing explosive growth in business and have installed NAS or older Direct Attached Storage (DAS) storage.
- Customers who are concerned with managing large data stores and are cognizant of the impact of a heterogeneous environment.
- Customers who manage business continuance issues and data retention issues within their organization, where it is a corporate strategy to have different methods for sharing and managing data.
- Customers who are looking for an enhanced storage infrastructure solution, such as those customers with installed SUN server-attached storage.

## 2.3 Application Best Fits

This solution is effective in IT environments that require the following:

- More efficient use of disk resources. By allowing up to eight logical units in a storage pool, this solution can allow for a smaller initial disk investment and smaller planning increments, leading to more efficient disk allocation.
- The ability to respond to unplanned or frequent volume growth or to cover situations in which disk utilization is consistently under-forecasted.
- Quick restores or frequent user restore requests.
- An additional data protection scheme that provides 24 hour database protection, where the time to perform more frequent tape backups is not available.

- A single package that provides both online volume growth and snapshots with Virtual Replicator V2.5 software.

### **3.0 Installing, Configuring, and Managing SAN and NAS Components**

This section provides some general guidelines for installing and configuring the stand-alone NAS Executor E7000, which uses storage provided by an MA8000, and which is managed using the San Management Appliance. This section covers the following tasks, which should be completed as follows:

- Installing the MA8000/EMA12000.
- Configuring the Fibre Channel switches.
- Setting up the SAN Management Appliance.
- Configuring the NAS Executor E7000.
- Managing storage on the integrated NAS/ SAN environment.
- Configuring the Enterprise Backup Solution.

#### **3.1 Installing the MA8000/EMA12000**

To correctly install the MA8000 storage subsystem, refer to the following documentation provided with the system.

Installation and configuration documents:

<http://www.compaq.com/products/storageworks/ma8kema12k/documentation.html>

MA8000/EMA12000 and RA8000/ESA12000 Fibre Channel Storage System Installation Poster:

<http://www.compaq.com/products/storageworks/techdoc/raidstorage/EK-MAEMA-IA-A01.html>

HSG80 ACS Solution Software V8.6 for Windows 2000 and Windows NT Installation and Configuration Guide:

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/raidstorage/AA-RFA9F-TE.pdf>

#### **3.2 Cabling and Configuring the Fibre Channel Switches**

You can review the installation and configuration instructions in the reference guide that is included with the switch. Review the SAN rules and the SAN Switch Management Guide for more information regarding SAN environments and switch management.

Fibre Channel product home page documentation:

<http://www.compaq.com/products/storageworks/fcsanswitch816/documentation.html>

Fibre Channel SAN Switch 16 Installation and Hardware Guide:

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/interconnect/EK-BCP28-IA-C01.pdf>

Fibre Channel SAN Switch Management Guide:

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/interconnect/AA-RMMJB-TE.pdf>

### Switch port management

Web Management Tools let you monitor status and performance of your Fibre Channel SAN switches. You can use these tools to display information and interact dynamically with the switches to make topology decisions and administrative changes. You can monitor and manage all of the SAN switches in a fabric from a workstation.

Web tools can be used for out-of-band switch management using a Web browser. Windows NT systems require installation of Sun's JRE 1.2.2 or higher, which can be obtained for free from the Sun Microsystems website. The Management Appliance and Network View software can also be used for switch port management.

## 3.3 Configuring the SAN Management Appliance

The SAN Management Appliance is a host-independent appliance that provides continuous SAN monitoring and event notification. It works with many different SAN devices, including all *StorageWorks* switches and arrays. The Management Appliance runs the Open SAN Manager (OSM) software. OSM facilitates a number of enterprise-wide storage management functions through a variety of management applications that can reside on the appliance.

By providing an integrated user interface for SAN elements, the Management Appliance simplifies management tasks and reduces management costs. The Management Appliance performs management functions without involving host computers, by accommodating mixed computing platforms connected on an Open SAN.

This guide briefly describes how to begin using the Management Appliance once it has been installed at your site. Start-up procedures, accessing the network, and descriptions of the applications are provided in the following sections:

- **Start-up** – Provides information on powering up the Management Appliance after it is installed in the rack
- **Using Open SAN Manager** – Describes accessing OSM over a network, navigating the user interface, and the services that OSM provides
- **Open SAN Manager Applications** – Provides descriptions of the applications that are launched from OSM

### Start-Up

Detailed storage environment configuration information is provided in the Management Appliance Configuration Guide. Information on installing the equipment is located in the Management Appliance Rack Installation Guide. Once the Management Appliance has been

installed and connected to the SAN, you can power up the Management Appliance. Here are the website locations for the Management Appliance documents:

Hardware Installation Poster

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/managementappliance/AV-RS0DA-TE.pdf>

Management Appliance Rack Installation Guide

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/234874-001.pdf>

Management Appliance Getting Started Guide

<ftp://ftp.compaq.com/pub/products/sanworks/managementappliance/234873-001.pdf>

Management Appliance Configuration Guide

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/managementappliance/244979-003.pdf>

Management Appliance Update Release Notes

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/managementappliance/AA-RNEAF-TE.pdf>

Management Appliance Hardware Evolution – Describes the differences between the two versions of the Management Appliance.

<http://www.compaq.com/products/sanworks/managementappliance/documentation.html>

### ***Using Open SAN Manager***

Open SAN Manager (OSM) is installed on and runs on the Management Appliance. OSM is an intuitive user interface that provides the following:

- A single point of management for all SAN applications and resources.
- A single Web-based management point on the SAN.
- An installation and launching point for applications and storage resource interfaces that allows you to easily visualize, configure, and monitor your SAN.

OSM enables you to perform a number of enterprise-wide storage management functions, which include:

- Monitoring SAN elements for failure, warning, and informational events
- Element management and accounting services for storage resources

You can access the appliance with a network browser. To launch the browser:

- Go to <http://swmaxxxxxx:2301>. The letters xxxxxx are the last six characters of the appliance serial number. Letters in the serial number must be in upper case. For example, an appliance with a serial number ending in 31K048 would have a URL of <http://swma31K048:2301>
- Login to OSM.

## Open SAN Manager Applications

OSM provides a launching point for applications and storage resource interfaces, and also lets you organize, visualize, configure, and monitor your SAN. OSM allows you to navigate to your SAN storage components to manage them directly and to manage multivendor storage subsystems.

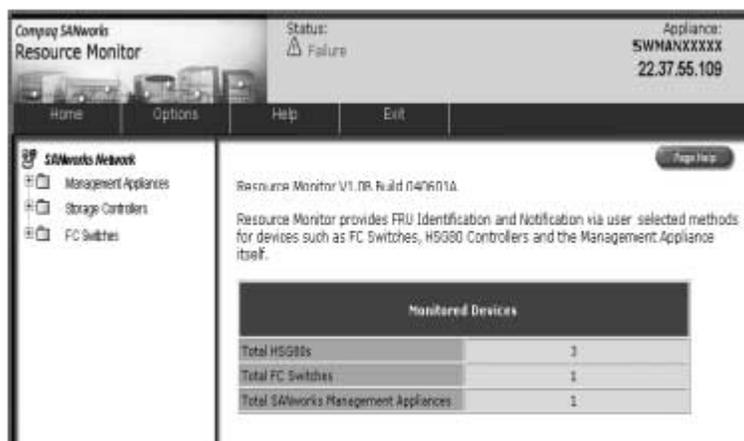
Here are the applications that you can use with OSM:

- Resource Monitor (With the January 2002 SAN Manager Appliance update, Resource Manager replaces the words “Resource Monitor”. The functionality is identical.)
- Element Manager for HSG80
- Storage Allocation Reporter
- Network View

## Resource Monitor

Resource Monitor (see Figure 3-1) provides Field Replaceable Unit (FRU) identification and event notification via user-selected methods for the following devices:

- Management appliances
- Fibre Channel switches
- Storage controllers



**Figure 3-1: Resource Monitor Window**

Resource Monitor automatically reports the status of supported monitored devices. Notification of event information is broadcast via the following:

- **Pager**

- **E-mail**
- **Web browser**
- **SNMP traps**

**NOTE:** For future Diagnostic Services applications, go to the Compaq website at <http://www.compaq.com/sanworks>

- **Management Appliances** — You can view properties, events logs, and configure the pager, E-mail, and SNMP traps for notification on monitored Management Appliances.
- **Storage Controllers** — You can view properties, event logs, and configure the pager, E-mail, and SNMP traps for notification on monitored storage controllers.
- **Fibre Channel Switches** — You can view properties, event logs, and configure the pager, E-mail, and SNMP traps for notification on monitored switches.

Element Managers are launched from the Resource Managers folder in the OSM Navigation pane (see Figure 3-2).



**Figure 3-2: Element Managers**

### ***Element Managers***

The Element Manager for the HSG80 array controller lets you configure and monitor HSG controllers. For each controller pair, the Element Manager lets you do the following:

- View existing virtual disk, controller, physical disk, and host properties.
- Make changes to properties for different configurations.
- Configure Remote Copy sets and add associations.
- Dynamically expand volumes for operating systems that support dynamic volume expansion, such as Windows 2000.
- Make temporary snapshots of volumes for backup purposes.

**NOTE:** Storage subsystems monitored by Resource Monitor must also be configured for monitoring by Element Manager for HSG.

### ***Storage Allocation Reporter***

The Storage Allocation Reporter (SAR), located in the Accounting Services folder, allows you to monitor your SAN for accounting purposes. Storage Allocation Report (SAR) is a reporting and billing application with the following functions:

- Determines the amount of storage reserved by customers
- Determines the quality of service reserved by customers
- Assigns storage cost for the reserved Logical Unit Number (LUN) capacity and level of service
- Notifies the customer of critical alerts

SAR provides a Web-based user interface to generate reports based on the amount of storage and quality of service reserved by customers. A pricing model is built into the SAR and calculates charges on a per-gigabyte, per-day basis. SAR provides the level of information necessary to determine the cost of the storage elements and services for cost-recovery purposes for both internal and external customers.

### **Network View**

Network View is installed and accessed by OSM and runs on the Management Appliance. Network View uses multiple methods to monitor SAN devices and also provides access to device-specific management applications. Network View provides a clear visual picture of the SAN structure. Here is the location of the Network View V2.0 Installation Guide:

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/networkview/AA-RP8AB-TE.pdf>

### **Features**

- Web-based user interface
- Automatic discovery of SAN devices and connections
- Launch Compaq Insight Manager (CIM) for discovered ProLiant hosts
- Display performance attributes for SAN devices and connections
- History and real-time performance-based graphs
- Statistical analysis for SAN devices
- Set performance thresholds for devices
- Performance database compression
- Zone visualization
- Grouping of devices
- User-specified SAN devices and connections
- Tree view of SAN devices
- Network map of SAN devices and connections
- SAN device icons that open device-specific applications

- Status, performance, and database alert and notification functions
- Event logging functions for a SAN
- Compatibility with many different manufacturers and models of SAN devices

### Overview of the Network View Window

After launching Network View from OSM, the Network View window appears, as shown in Figure 3-3. The Session pane, Navigation pane, and Content pane are used to manage and configure your SAN and Network View.

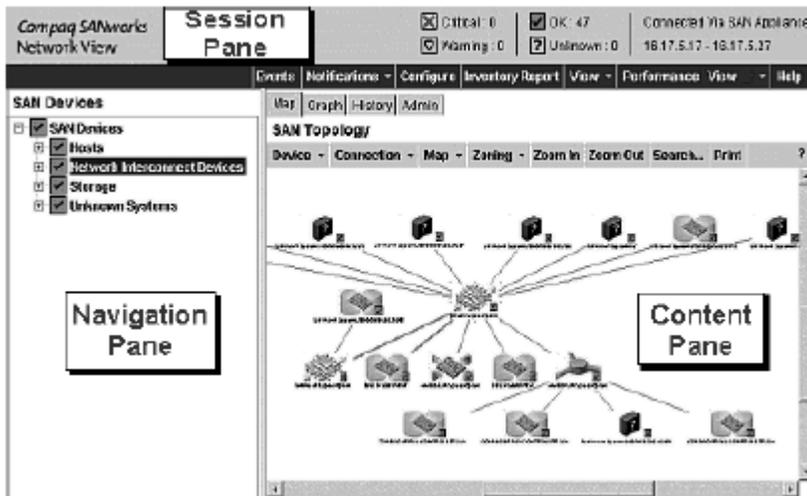


Figure 3-3: Network View window

#### Session Pane

The Session pane is located at the top of the Network View window, as shown in Figure 3-3. The Session pane displays status information and contains the global options. Global options consist of drop-down menus, buttons, or a combination of both. These options pertain to the application as a whole, as opposed to map options that only pertain to the map displayed in the Content pane.

#### Navigation Pane

The Navigation pane is located at the left-hand side of the Network View window, as shown in Figure 3-3. The Navigation pane displays a list of devices in the SAN. Depending on the layout you select in the View menu, the display may appear as either a tree or list view.

#### Content Pane

The Content pane is located to the right of the Navigation pane on the Network View window, as shown in Figure 3-3. The Content pane presents all map options as buttons, drop-down menus, or a combination of both. When you select a device in the Content pane, the appropriate network map options become enabled and are displayed. If you do not select a device, the only enabled map options are those that are device-independent. Device status and topology map views are also displayed in the content pane. The Content pane displays device icons, connections, and the status of SAN devices. The Content pane also displays the following Performance tabs:

- **Map** – Displays the devices (SAN Topology objects) on the network map.
- **Graph** – Displays a history of performance information for selected devices. To view performance history on devices, the devices must be logging information in the database.
- **History** – Displays historical performance data over a selected time period for a selected device. You can export historical data for later viewing.
- **Admin** – Displays a table of devices that are enabled for monitoring by Performance View.

### Notifications and Events

Network View is an event-driven system, which means that all data flows within the SAN are in the form of events. When an event such as a discovery, a device status change, or a performance threshold change occurs, the server program or host agent sends an event to the event log.

Network View allows you to set up alerts or notifications for specific events that occur throughout the SAN. For example, if devices fail and reach a critical status, you may want to define notifications that send an E-mail or SNMP trap.

### Performance View

Network View can be used to track and record the performance for SAN devices and connections. By monitoring this real-time information, you can analyze long-term trends and make future projections. The Logging Configuration window is used to set up the devices to record performance data. Using the various graphs and performance thresholds, you can monitor devices in the SAN. You can export the performance data to other applications. Performance View allows you to view the following graphs:

- **Live** – Displays real-time performance data on selected devices
- **History** – Displays historical performance data over a selected time period for selected devices
- **SANmeter** – Displays the most active devices currently being monitored (either by the Live Graph or the Historical Graph)

### Zone Visualization

A zone is a collection of ports arranged into a specific grouping in a fabric. Network View allows you to view zones or groups of zones in the content pane. Zones and configurations can be viewed on the topology map using the zone viewer. Network View uses colored objects to group zones together.

### Device Groups

A device group is a set of devices that are grouped together based on geography, organizational structure, or other user-defined criteria. Network View allows you to select devices on the content pane and group them together with a single icon.

### Monitoring Devices

Information regarding devices discovered by the system is stored and displayed in device and connection properties windows. Detailed information and cross-platform parameters, such as system name, TCP/IP address, OS name, device type, port, and version are displayed.

### Inventory Reporting

Network View allows you to print reports on devices based on user-specified device properties. You can create an inventory report in .txt, .csv, .htm, or .xml format. For example, you can create a report to list the serial numbers of all of your storage devices instead of having to look at each individual device.

### Using Miscellaneous Map Functions

Network View provides a graphical network map of devices and connections in your SAN. Device icons are displayed on the map and can be used to open device-specific applications. Network View allows you to manipulate the network map by moving to different areas in the SAN, printing the map, refreshing the map, displaying grid lines, displaying different views, redrawing connection lines, and searching for devices.

## 3.4 Configuring NAS Executor E7000

This section describes the configuration options, setup and configuration dependencies, and requirements for the NAS Executor E7000. For additional information on the topics covered in this guide, refer to the following documentation:

NAS Executor E7000 Quick Start Guide

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/e7000/259129e1.pdf>

NAS Executor E7000 Release Notes.

Includes information on creating virtual disks with Virtual Replicator

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/e7000/261259e2.pdf>

The following documents are provided on the documentation CD-ROM that ships with the NAS E7000.

- *StorageWorks* NAS Executor E7000 Quick Initialization poster
- *StorageWorks* NAS Executor E7000 Administration Guide
- *StorageWorks* NAS Executor E7000 Hardware Reference Guide

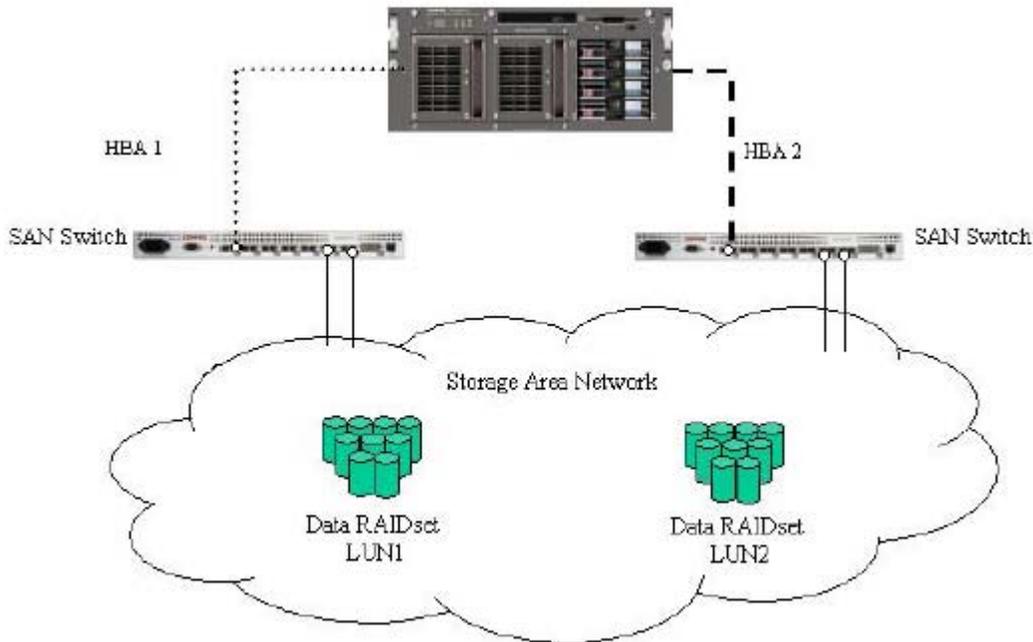
You can implement the NAS E7000 attached to a storage area network in two different configurations, as a single NAS device or as a clustered pair. This solution guide only describes the NAS as a single device. For information on clustered environments, refer to the NAS documentation.

### ***NAS E7000 as a Single Device Attached to a SAN***

In the single NAS device configuration, a NAS E7000 is attached to a SAN via a pair of Fibre Channel host bus adapters (HBAs) and two SAN switches as illustrated in Figure 3-4. Each HBA should be connected to a separate switch that has access to the same controller pairs. This connection method allows redundant paths to the same storage subsystem. The redundant path can take two forms that are known as multibus and transparent failover. These modes are set at the controller level.

SAN storage is not managed by the NAS E7000 and requires coordination between the NAS administrator and the SAN administrator. LUN requests need to be made and assigned to the NAS E7000 using selective storage presentation from the SAN controller pairs. Naming of the LUNs and the connections to the NAS E7000 is important for tracking and identification

purposes. At least one LUN is required for use by the NAS E7000 in order for the device to be functional.



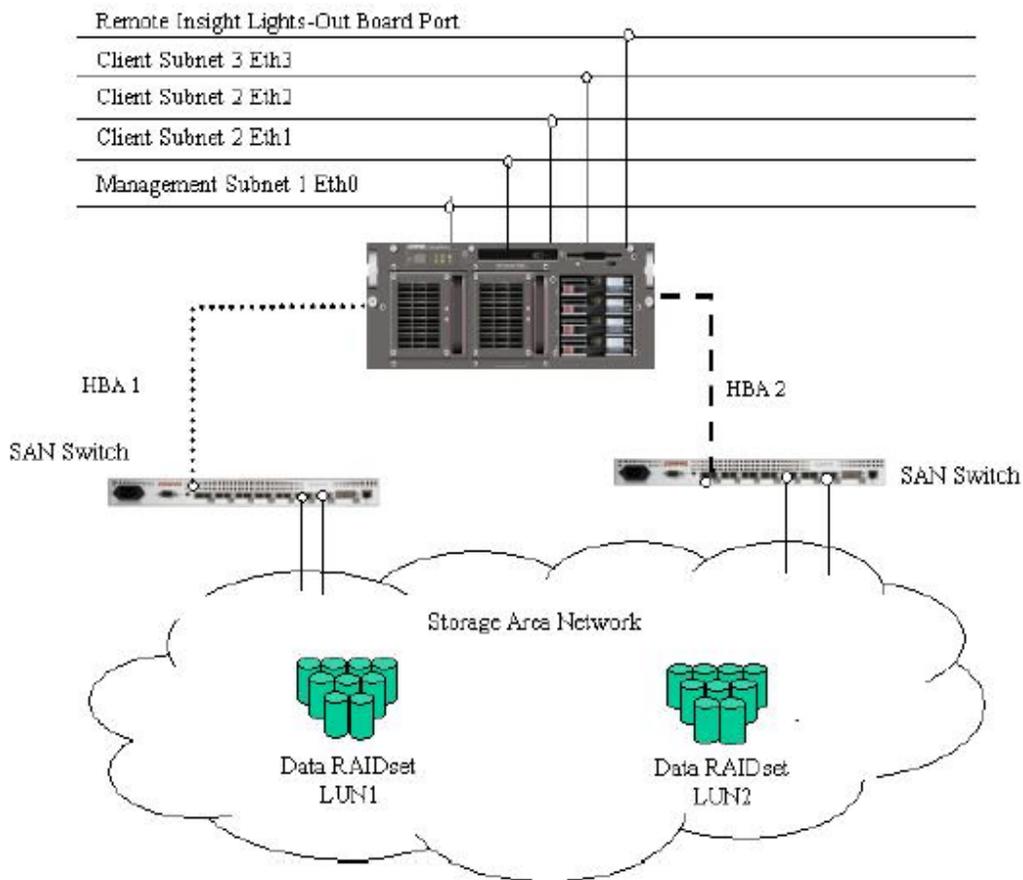
**Figure 3-4 NAS E7000 as a single device**

### ***Understanding Single Device Network Deployment***

In a single device deployment, network connections are divided into two categories: client data segments and management segments. The default shipping configuration contains a four-port network interface controller (NIC) card. Compaq recommends that you use one port for management and the other three ports for client data. Rapid Launch is a part of the Web interface that you can use to remotely connect to the E7000 to pre-configure network settings. You can also use the Web user interface to accomplish most management and administrative procedures. An additional management port for remote console and diagnostics is provided from the Remote Insight Lights-Out Edition (RILOE) board. Compaq recommends that this connection be placed on a management LAN separate from the corporate infrastructure.

The NAS E7000 supports the use of NIC teaming. NIC teaming provides failover and load balancing of network ports of the NAS E7000. NIC teaming requires the network cables to be installed on the same subnet to enable it to work.

For example, in Figure 3-5, Eth1, Eth2, and Eth3 would need to be on the same subnet to enable this functionality on those ports. However, it is not recommended to assign IP addresses to the ports that will be teamed or load balanced prior to the installation and setup of NIC teaming. For this reason, Compaq recommends that you set all network ports to DHCP. For information concerning the configuration of NIC teaming after setup is complete, see the NAS Executor E7000 Administration Guide.



**Figure 3-5: Example of NAS E7000 single device deployment**

The following conditions must be met in order for the NAS E7000 to operate as a single device.

- Storage object requirements
- Storage network requirements
- IP networking requirements

#### Storage Object Requirements

- MA8000, MA12000, MA16000, and Enterprise Virtual Array
- ACS firmware (8.6 version only)
- SAN-based storage composed of RAID 3/5 RAIDsets

**NOTE:** All RAIDsets are supported, but it is recommended that you use RAID 3/5 for the best combination of availability, performance, and space efficiency.

#### Storage Networking Requirements

- One open port on each of the two SAN switches that access the same storage controller pairs

- Two Fibre Channel cables

### IP Networking and Setup Requirements

- A single Ethernet connection on a switch or hub for the RILOE board  
**NOTE:** The RILOE board connection is optional, but recommended.
- A single Ethernet connection for the management subnet of the NAS E7000  
**NOTE:** A management subnet provides for the best security and is optional, but recommended.
- Additional Ethernet connection ports to client subnets (depending on network options ordered).
- Windows-based PC running Microsoft Internet Explorer 5.5 (or greater) on the same network segment as the NAS E7000 management port (Eth 0), which will be used to set up the NAS device.

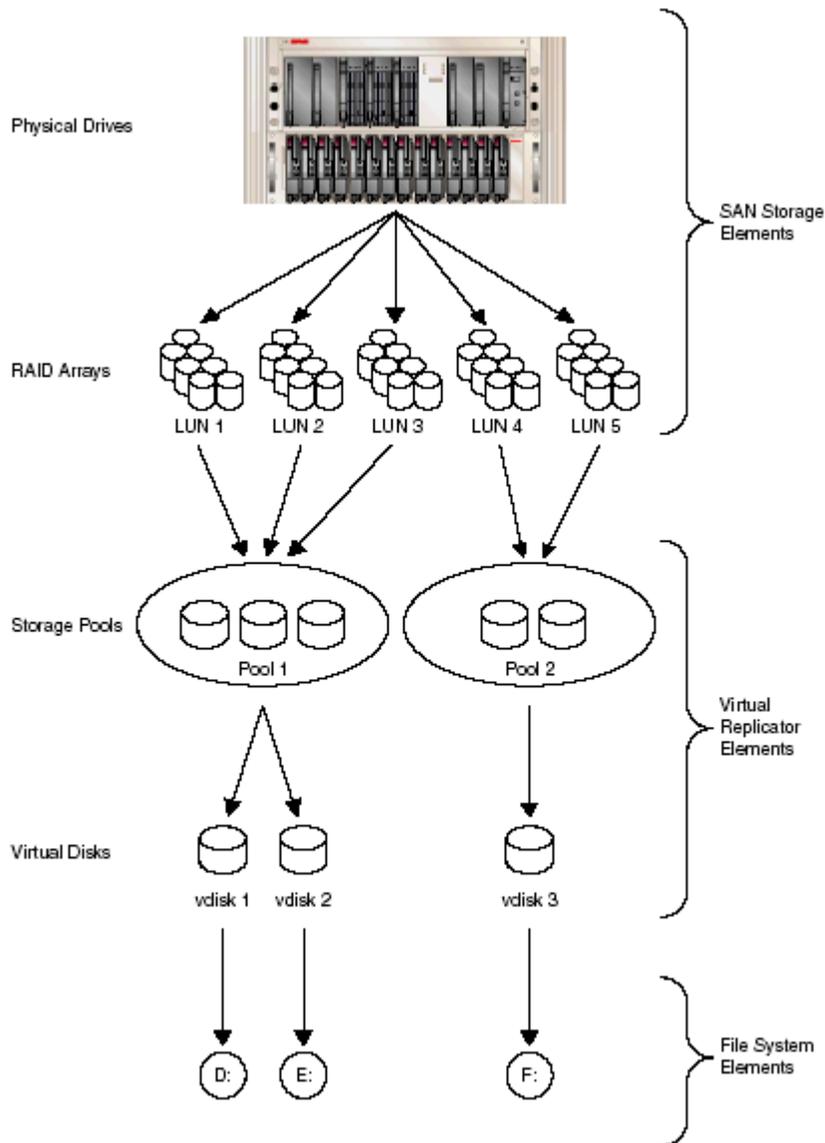
**Important:** The RapidLaunch client and NAS E7000 must be on the same network segment as the management port (Eth 0), or RapidLaunch will not detect the NAS E7000.

## 3.5 Managing Storage on the Integrated NAS and SAN

This section provides an overview of the components that make up the NAS storage structure. A complete reading of the components and their relationships may be found in these administration guides:

- NAS Executor E7000 Administration Guide, which is located on the product CD
- Online Help System for Virtual Replicator V2.5

**CAUTION:** This section on storage management and Virtual Replicator on a SAN is required reading material for the NAS/SAN administrator. This section develops the concepts and requirements that serve as the basis for successfully using a NAS device on the SAN. Knowledgeable administrators should read this section and the appropriate sections on storage management in the administration guides to protect the storage subsystem from data loss or file corruption.



**Figure 3-6: Storage management process**

Figure 3-6 provides an illustration of the various storage components of the NAS E7000. Storage is broken up into three types of elements and each of these elements is composed of the previous level's elements.

- **SAN Storage Elements** are managed with the SAN Management Appliance. The lowest level of storage management on the NAS E7000 occurs at the physical drive level. Physical drives are placed into the external storage enclosure or enclosures of the SAN storage network and are grouped into RAIDsets for fault tolerance and better performance.
- **Virtual Replicator Elements and File Elements** are managed with the NAS Web GUI. Virtual Replicator provides volume virtualization for the NAS device by allowing for the creation of virtual disks from Virtual Replicator pools, which contain the LUNs managed on the SAN. These pools are logical abstractions that aggregate the disk space from one or more LUNs into a large set of disk blocks. From the pool of blocks, virtual disks are

created and presented to the operating system as New Technology File System (NTFS) volumes. Without interrupting service, virtual disks can be dynamically grown online when there is a need for more space. When using Virtual Replicator, review the following constraints:

- There is a maximum of 256 LUNs available to the connected NAS devices.
  - If multiple LUNs are used to form a pool, they must all be from the same HSG80 controller pair.
  - Disk Administrator from Windows 2000 should not be used to manage Virtual Replicator disks. The two management tools do not have an awareness of each other and compatibility issues can arise between the two management tools.
  - A pool can consist of eight LUNs. In addition, a pool should not be larger than 16TB in size since that is the maximum amount of virtual disk space that can be used, although the pool could be larger to allow for snapshot space.
  - The LUNs composing a Virtual Replicator pool must be treated synchronously. For example, if LUNs 8, 9, and 10 are used to compose a single pool, and LUN 9 is restored from a backup, snapshot, or clone, the Virtual Replicator pool would be corrupted, resulting in complete data loss.
  - A maximum of eight virtual disks can be carved out of a single pool.
  - Each virtual disk must be presented as a drive letter or a mount point on the NAS device for users and the operating system to be able to access the virtual disk. Although it is possible to create a virtual disk and not map it to a drive letter or mount point, neither the users nor the administrator would have access to the storage space contained within that virtual disk.
  - All the units that make up a pool should have the same high availability characteristics (RAID levels and striping methods). If one LUN member of the pool goes offline, the entire pool is unavailable.
  - The current version of NAS does not support the use of CONCATSETS (concatenated sets). Virtual Replicator pool participants must remain the same size. Virtual Replicator also performs the same function as CONCATSETS, so this functionality is provided at the software level, rather than at the controller level, by adding LUNs to the pool.
  - When using Data Replication Manager (DRM) for remote data replication, the LUNs of a pool must all be treated synchronously. When using DRM, be sure to group all the LUNs of a single pool into an association set so that the LUNs are kept in sync as they are replicated to the remote or target storage subsystem.
- **File System Elements.** The file systems are NTFS formatted with drive letter assignments from the virtual disks that are created by Virtual Replicator.

### 3.6 Configuring the Enterprise Backup Solution

Enterprise Backup Solution (EBS) is an integration of backup and restore application software with industry-standard hardware for a complete enterprise class solution. Compaq has joined with leading software companies to provide software solutions that support the backup and restore processes of homogeneous and heterogeneous operating systems. You need the following components to configure EBS for this solution:

- Windows 2000 Server containing Fibre Channel Host Bus Adapters with Secure Path 3.1A
- Modular Data Router
- Tape Library

#### ***Enterprise Backup Solution Backup Software Features***

EBS software solutions incorporate database protection, storage management agents, and options for highly specialized networking environments.

Storage management software focuses on data backup and restore using an automated digital linear tape (DLT), super digital linear tape (SDLT), or advanced intelligent tape (AIT) library and Fibre Channel technology. EBS combines the functionality and management of EBS Storage Area Network (SAN), high-availability software, and scaling tools to integrate tape and disk storage subsystems in the same SAN environment.

**NOTE:** Compaq has provided a compatibility matrix as an aid to matching EBS components. You can access the compatibility matrix at:

[www.compaq.com/products/storageworks/ebs/EBScompatmatrix.html](http://www.compaq.com/products/storageworks/ebs/EBScompatmatrix.html)

#### ***Sizing***

To analyze the performance of the Enterprise Backup Solution, Compaq designed a test suite to emulate real-world applications. The principles of the five components in the “Performance and Tuning” section were applied to all components to optimize system performance. By carefully analyzing the interrelationships between these components, Compaq generated formulas to accurately define backup windows and design systems for lights-out operations.

To run successful hands-off, lights-out operations, systems must be sized to fit backup windows and ensure sufficient tape retention. This provides safe, unattended backups with minimal operator intervention. Full, incremental, and differential selected backup jobs were analyzed, and the effects of tape changes and application overhead were applied to clarify the overall operations. These exhaustive tests have resulted in the Compaq *StorageWorks* Backup Sizing Tool. This one-of-a-kind Compaq application quickly analyzes complex environments while predicting requirements and performance expectations. You can download the Backup Sizing Tool and you can review the white paper, *Sizing the Compaq StorageWorks Enterprise Backup Solution*, from [www.compaq.com/ebs](http://www.compaq.com/ebs).

The EBS Sizer is a Windows-based tool used to determine a backup solution based on the information supplied by the user. Before beginning the sizing process, the user must have a thorough understanding of the network, the type of data to be backed up, and the backup window parameters. The Sizer optimizes the EBS based on user input.

### The *StorageWorks* EBS Sizer

- Accepts user input
- Allows the user to select the options and agents that are offered by the independent software vendor
- Performs calculations for realistic performance
- Performs the calculations necessary for backup and tape retention
- Configures a solution for a single data zone or a larger solution or domain
- Generates a report and a proposal for a solution

### **Installation Instructions**

The following steps explain how to connect and configure the EBS to a Storage Area Network:

1. Install the BackUp Server (Windows 2000 Server with SP2).
2. Install the *StorageWorks ACS* solution kit for ACS 8.6-4F for Windows 2000 including SWCC agent and client software. See the installations instruction for more detail. Version 8.6-4 is what was used in this solution. V8.7 is not supported yet on the NAS.
3. Install SecurePath V3.1A for Windows on the backup server if it has multiple Fibre Channel host bus adapters. Secure Path V3.1A was used in this solution and is the minimum supported version for this solution.
4. Install the Tape Library hardware according to the quick installation instructions. You can connect the library to the Modular Data Router (MDR) using the instructions included with the library. You need to physically connect the SCSI cables and terminators between the library and the Modular Data router according to the supplied instructions.
5. Connect the Modular Data Router to the FC switch (powered on) using a fiber cable.
6. Power on the library, allowing time for it to complete the POST diagnostics.
7. Power on the MDR.
8. On the Windows 2000 Backup Server, run Hardware Install from the control panel. Then load the drivers that shipped with the library.
9. Load your backup software on the backup server and the required agents.
10. Perform backup according to your backup strategy and strategies recommended by the backup software vendors.

**NOTE:** Check for updated drivers and firmware periodically at:

<http://www.compaq.com/support/storage/index.html>

## 4.0 Working with HP Services

You can work with HP Services to help you plan, set up, install, and configure your hardware and software components. Here is a list of services for you to review:

- ***SANworks* Management Appliance Installation & Startup Service**  
A fixed-priced service package specifically designed for customers who need assistance with installing and configuring their newly purchased *SANworks* Management Appliance and the included *SANworks* software
- ***StorageWorks* NAS Executor E7000 Installation & Startup Service**  
Designed for customers who require assistance to install their newly purchased *StorageWorks* NAS Executor E7000s and to perform the configuration activities necessary to provide clients access to data residing on a SAN, through NAS technology
- ***StorageWorks* Enterprise Backup Solution Installation & Startup Services**  
Designed as statement of work services for customers who need assistance installing and deploying their newly purchased Storage Subsystems, backup software installation, and orientation to the functionality of backup hardware and software products.
- **RAID StorageSet I & S Service for Medium SANs**  
A set of fixed-priced service packages specifically designed for customers who need assistance installing their newly purchased RA8000/MA8000, ESA12000/EMA12000, or EMA16000 storage subsystem and designing, creating, and configuring RAID storage sets for those storage subsystems. Service packages are for onsite delivery only.

## 5.0 Related Information

### 5.1 Related Documents

EBS compatibility matrix

[www.compaq.com/products/storageworks/ebs/EBScompatmatrix.html](http://www.compaq.com/products/storageworks/ebs/EBScompatmatrix.html)

Installation and configuration documents for the MA8000:

<http://www.compaq.com/products/storageworks/ma8kema12k/documentation.html>

MA8000/EMA12000 and RA8000/ESA12000 Fibre Channel Storage System Installation Poster:

<http://www.compaq.com/products/storageworks/techdoc/raidstorage/EK-MAEMA-IA-A01.html>

HSG80 ACS Solution Software V8.6 for Windows 2000 and Windows NT Installation and Configuration Guide: <ftp://ftp.compaq.com/pub/products/storageworks/techdoc/raidstorage/AA-RFA9F-TE.pdf>

Fibre Channel product home page documentation:

<http://www.compaq.com/products/storageworks/fcsanswitch816/documentation.html>

Fibre Channel SAN Switch 16 Installation and Hardware Guide:

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/interconnect/EK-BCP28-IA-C01.pdf>

Fibre Channel SAN Switch Management Guide:

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/interconnect/AA-RMMJB-TE.pdf>

Hardware Installation Poster

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/managementappliance/AV-RS0DA-TE.pdf>

Management Appliance Rack Installation Guide

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/234874-001.pdf>

Management Appliance Getting Started Guide

<ftp://ftp.compaq.com/pub/products/sanworks/managementappliance/234873-001.pdf>

Management Appliance Configuration Guide

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/managementappliance/244979-003.pdf>

Management Appliance Update Release Notes

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/managementappliance/AA-RNEAF-TE.pdf>

Management Appliance Hardware Evolution – Describes the differences between the two versions of the Management Appliance.

<http://www.compaq.com/products/sanworks/managementappliance/documentation.html>

NAS Executor E7000 Quick Start Guide

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/e7000/259129e1.pdf>

NAS Executor E7000 Release Notes.

Includes information on creating virtual disks with Virtual Replicator

<ftp://ftp.compaq.com/pub/products/storageworks/techdoc/e7000/261259e2.pdf>

These documents are on the CD-ROM that ships with the NAS E7000.

- *StorageWorks* NAS Executor E7000 Quick Initialization poster
- *StorageWorks* NAS Executor E7000 Administration Guide
- *StorageWorks* NAS Executor E7000 Hardware Reference Guide

Network View V2.0 Installation Guide:

<ftp://ftp.compaq.com/pub/products/sanworks/techdoc/networkview/AA-RP8AB-TE.pdf>

Sizing the Compaq StorageWorks Enterprise Backup Solution,

[www.compaq.com/ebs](http://www.compaq.com/ebs).

## 5.2 Related Websites

MA8000/MA12000 product home page

<http://www.compaq.com/products/storageworks/ma8kema12k/index.html>

SAN Appliance product home page

<http://www.compaq.com/products/sanworks/managementappliance/index.html>

NAS E7000 product home page

<http://www.compaq.com/products/storageworks/e7000/index.html>

FC SAN Switch product home page

<http://www.compaq.com/products/storageworks/fcsanswitch816/index.html>

EBS product home page

<http://www.compaq.com/products/storageworks/ebs/index.html>