

Implementing HP Storage Software Solutions

ESG10976SG0308

student guide



Implementing HP Storage Software Solutions

ESG10976SG0308



training

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Implementing HP Storage Software Solutions

Student Guide

August 2003

Introduction

| | |
|---|---|
| Objectives | 1 |
| Introduction | 2 |
| Recommended storage technical training curriculum | 3 |
| Course prerequisites | 3 |
| Course objectives..... | 4 |
| Course agenda | 5 |

Module 1 — ENSAextended and Storage Software Overview

| | |
|--|----|
| Objectives | 1 |
| Enterprise Network Storage Architecture Extended | 2 |
| Building on the storage utility..... | 4 |
| Extending the storage utility | 5 |
| Adaptive storage infrastructure | 5 |
| ENSAextended architecture | 7 |
| Networked storage | 7 |
| Virtualization..... | 8 |
| Data services | 8 |
| Application integration..... | 9 |
| Views | 9 |
| Active intelligent management | 10 |
| Software..... | 11 |
| Storage area management software | 11 |
| Open View Storage Area Manager | 11 |
| Storage Allocator | 11 |
| Storage Allocator | 12 |
| Storage Optimizer..... | 12 |
| Storage Builder | 12 |
| Storage Node Manager | 12 |
| OpenView Storage Provisioner..... | 13 |
| OpenView Storage Management Appliance | 13 |

| | |
|--|----|
| Device and configuration management software | 13 |
| StorageWorks Command View XP | 13 |
| StorageWorks Command View EVA | 14 |
| StorageWorks Command View Storage Device Management | 14 |
| StorageWorks Secure Manager XP | 14 |
| StorageWorks LUN Configuration Manager XP | 14 |
| StorageWorks LUN Configuration and Security Manager XP | 14 |
| Array Configuration Utility XE (for MSA) | 15 |
| Performance management software | 15 |
| StorageWorks Performance Advisor XP | 15 |
| StorageWorks Application Policy Manager | 15 |
| StorageWorks Auto LUN XP | 16 |
| StorageWorks Cache LUN XP | 16 |
| OpenView Storage Optimizer | 16 |
| Information lifecycle management software | 16 |
| OpenView Storage Data Protector | 16 |
| OpenView Storage Media Operations | 17 |
| Replication software | 17 |
| OpenView Continuous Access Storage Appliance | 17 |
| OpenView Storage Virtual Replicator | 18 |
| StorageWorks Business Copy XP | 18 |
| StorageWorks Business Copy EVA | 19 |
| StorageWorks Business Copy VA | 19 |
| StorageWorks Continuous Access EVA | 20 |
| StorageWorks Continuous Access XP and XP Extension | 20 |
| Multi-pathing software | 20 |
| StorageWorks Secure Path | 20 |
| StorageWorks Auto Path XP and VA | 21 |
| Business continuity software | 21 |
| StorageWorks Cluster Extension XP | 21 |
| Virtualization software | 21 |
| Platform software | 22 |
| StorageWorks XP disk array software | 22 |
| StorageWorks Resource Manager XP and Data Exchange XP | 22 |
| StorageWorks Fast Recovery solutions | 22 |
| StorageWorks Data Integrity Check | 22 |

| | |
|---|----|
| StorageWorks EVA software | 23 |
| SmartStart Scripting Toolkit..... | 23 |
| StorageWorks Virtual Controller software | 23 |
| StorageWorks VA software | 23 |
| StorageWorks Secure Manager VA..... | 23 |
| StorageWorks Fast Recovery solutions | 23 |
| StorageWorks Modular Storage Array 1000 family software | 23 |
| StorageWorks MA/EMA family software | 24 |
| StorageWorks Command Scripter (for HSG)..... | 24 |
| StorageWorks Command Console (for HSG) | 24 |
| StorageWorks Data Replication Manager (for HSG)..... | 25 |
| StorageWorks HSG Element Manager..... | 25 |
| StorageWorks Array Controller software..... | 25 |
| StorageWorks Business Copy Upgrade UI MA/EMA | 25 |
| Learning check | 26 |

Module 2 — HP OpenView Storage Virtual Replicator

| | |
|---|----|
| Objectives | 1 |
| Overview | 2 |
| Benefits..... | 4 |
| Storage units | 6 |
| Storage pools | 7 |
| Virtual disks..... | 9 |
| Virtual disk mapping | 10 |
| Snapshots..... | 11 |
| Creating snapshots | 12 |
| How snapshots work | 13 |
| Displaying snapshot information | 15 |
| SmartSnap command | 15 |
| Snapshot planner | 17 |
| Task automation wizards..... | 19 |
| Incremental backup support | 20 |
| Managing pools | 21 |
| Adding storage units in a pool | 21 |
| Importing storage units | 22 |
| Remove storage units from pools..... | 23 |
| Understanding pool free space | 23 |
| Methods for monitoring pool free space..... | 24 |

| | |
|---|----|
| Online volume growth..... | 25 |
| Basic and virtual disks | 26 |
| Basic disks | 26 |
| Virtual disks..... | 26 |
| Growing virtual disks..... | 27 |
| Preparing for online volume growth..... | 27 |
| Virtual disks..... | 28 |
| Storage Virtual Replicator policy management | 29 |
| Storage Virtual Replicator Lifeguard service..... | 34 |
| Monitoring pool free space using the Lifeguard service..... | 34 |
| Monitoring pool free space in a Microsoft Exchange environment..... | 35 |
| Cluster support..... | 36 |
| SNMP support | 38 |
| User interface options..... | 39 |
| Microsoft Management Console interface | 39 |
| The command line interface..... | 40 |
| Support for Windows tools..... | 41 |
| Performance Monitor support | 41 |
| Mounted volume support | 42 |
| Disk defragmenter support..... | 42 |
| Interaction with other Windows tools | 43 |
| Interaction with other storage management tools..... | 43 |
| Installation prerequisites..... | 44 |
| Software | 44 |
| Hardware | 44 |
| Storage Virtual Replicator licensing | 45 |
| Installation | 46 |
| Learning check | 47 |

Module 3 — HP OpenView Storage Management Appliance

| | |
|-----------------------------|---|
| Objectives | 1 |
| Overview | 2 |
| Features..... | 3 |
| Hardware components | 4 |
| Hardware installation | 5 |
| Front panel LEDs | 6 |

| | |
|---|----|
| Software components | 7 |
| Storage Management Appliance operating system | 8 |
| Storage Management Appliance software | 9 |
| Browsing to the appliance | 11 |
| Passwords | 12 |
| Security | 13 |
| Navigating the user interface | 14 |
| Session pane | 14 |
| Content pane | 15 |
| Using the Home Page | 16 |
| Getting Started | 16 |
| Tools | 17 |
| Devices | 17 |
| My Links | 18 |
| hp.com | 18 |
| Using the Tools page | 18 |
| Using the Devices page | 19 |
| Discovered Devices | 19 |
| Command view eva | 20 |
| HSG element manager | 20 |
| Using the Status pages | 21 |
| Logs | 21 |
| Management Agents | 28 |
| Using the Settings Pages | 29 |
| Maintenance | 30 |
| Users | 32 |
| Discovery | 33 |
| Manage Tools | 35 |
| Network | 36 |
| Notification | 38 |
| Licensing | 40 |
| Automation | 40 |
| Remote Access | 43 |
| Using Help | 44 |
| Learning check | 45 |

Module 4 — — HP OpenView Storage Provisioner — Concepts, Installation and Operation

| | |
|--|----|
| Objectives | 1 |
| Overview | 2 |
| Provisioning storage | 3 |
| Features..... | 4 |
| Provisioning Framework | 5 |
| Areas of provisioning..... | 6 |
| Storage utilities | 7 |
| Service levels | 7 |
| Reporting | 8 |
| Installing and launching Storage Provisioner | 9 |
| System requirements | 9 |
| Software requirements | 9 |
| Installation process..... | 9 |
| Launching Storage Provisioner..... | 10 |
| Storage provider launch procedure..... | 10 |
| About the User Interface..... | 11 |
| Creating the provisioning environment | 13 |
| Discovering storage systems | 14 |
| Creating utilities | 15 |
| Assigning storage systems to a utility..... | 16 |
| Creating customer groups | 18 |
| Creating customer | 18 |
| Quotas | 20 |
| Service levels | 22 |
| Provisioning..... | 24 |
| Storage consumer launch procedure | 24 |
| Viewing a customer's environment | 25 |
| Host Groups and Hosts | 26 |
| Host Groups | 26 |
| Hosts | 27 |
| Paths | 27 |
| Creating Paths..... | 28 |
| Volume groups and volumes..... | 29 |
| Volume Groups..... | 30 |
| Volumes | 30 |
| Creating volumes | 31 |
| Accessing volumes | 32 |

| | |
|---------------------------------------|----|
| Reporting Tools | 33 |
| Viewing Reports | 34 |
| Current Usage Reports | 34 |
| Billing History Report | 35 |
| Exporting data | 35 |
| Printing Reports | 36 |
| Maintaining Storage Provisioner | 39 |
| Backing up data | 40 |
| Restoring Data | 41 |
| Diagnostics Logs | 42 |
| Troubleshooting | 44 |
| Diagnostic Logs | 44 |
| Events Tab | 44 |
| Viewing events | 45 |
| Dialog boxes | 45 |
| Informational messages | 46 |
| Warning messages | 50 |
| Error Messages | 51 |
| Browser issues | 53 |
| Storage Provisioner Roadmap | 56 |
| Learning check | 57 |

Module 5 — HP StorageWorks Business Copy EVA — Concepts and Operations

| | |
|---|----|
| Objectives | 1 |
| Overview | 2 |
| Key features and benefits | 4 |
| Replication methods | 5 |
| Snapshots | 5 |
| Clones | 6 |
| Comparing clones and snapshots | 7 |
| BC modes | 7 |
| BC modes for MA/EMA | 7 |
| Components of a BC Enhanced Mode Network | 8 |
| BC jobs | 9 |
| Creating a BC Job | 10 |
| Creating a BC job manually | 12 |
| Creating a BC job with a template | 13 |
| BC job operations | 13 |
| Jobs page | 15 |
| Running a job | 15 |
| Undoing a job | 16 |
| Aborting a job | 16 |
| Deleting a job | 16 |
| Sequential jobs | 16 |
| Parallel jobs | 17 |
| Job design rules | 18 |
| Job Design Recommendations | 19 |
| Logs | 20 |
| Configuration | 21 |
| Save/Reload | 21 |
| Subsystem options | 22 |
| Refresh interval | 22 |
| Storage Subsystems | 23 |
| HSG options | 23 |
| HSV options | 24 |
| Resources page | 24 |
| Help | 25 |
| BC command line | 25 |
| BC and HP OpenView Storage Virtual Replicator | 27 |
| Learning check | 28 |

Module 6 — HP StorageWorks Business Copy EVA — Planning and Installation

| | |
|---|----|
| Objectives | 1 |
| Overview | 2 |
| BC network components | 3 |
| BC server..... | 4 |
| BC hosts | 5 |
| Planning a BC network installation..... | 6 |
| Identifying the purpose of the BC network..... | 6 |
| Planning the BC server..... | 7 |
| Planning for BC host agents..... | 7 |
| Migration planning..... | 8 |
| BC network migration considerations | 8 |
| BC network configurations..... | 9 |
| Combination application and backup server | 10 |
| Application servers and backup server | 11 |
| Clustered application servers and backup server | 12 |
| Learning Check | 13 |

Addendum to Module 3 — HP OpenView Storage Management Appliance troubleshooting addendum (optional)

| | |
|--|----|
| Objectives | 1 |
| Operational status | 2 |
| System status LED indicators | 3 |
| Hard drive LED indicators | 4 |
| RJ-45 connector network status LED indicators..... | 5 |
| Fibre Channel adapter indicators | 6 |
| Troubleshooting HP OpenView Storage Management Appliance software..... | 7 |
| Troubleshooting Storage Management Appliance software login..... | 8 |
| Advanced help | 8 |
| Problems connecting to Storage Management Appliance | 10 |
| Storage Management Appliance software navigation pane | 11 |
| Navigation tree..... | 11 |
| Accounting and diagnostic links..... | 11 |
| Troubleshooting Storage Management applications | 12 |
| Installing or updating applications | 12 |
| CD install | 13 |
| Network install..... | 14 |
| Application status | 15 |
| HP StorageWorks HSG Element Manager | 16 |
| Subsystem not displaying or communication status failed..... | 16 |
| Subsystem data | 17 |
| Unable to communicate with subsystem | 18 |
| Appliance Manager | 19 |
| Returned to Appliance Manager home page | 19 |
| Renaming the Storage Management Appliance | 19 |
| HP SANworks Allocation Reporter | 20 |

| | |
|--|----|
| LUNs not found | 20 |
| Data is old, incorrect, or missing | 20 |
| Storage Management Appliance migration procedures | 21 |
| Supported Storage Management Appliance migration paths | 21 |
| Configuration before migration | 22 |
| Preferred migration path | 23 |
| Alternate migration path | 24 |
| Learning check | 25 |

Objectives

After completing this module, you should be able to:

- Locate the courses that constitute the HP storage training curriculum.
- Identify the key objectives for this course.

Introduction

The course, Implementing HP Storage Software Solutions, describes the concepts, installation and configuration of selected storage software applications. The applications discussed include the following:

- HP OpenView Storage Virtual Replicator
- HP OpenView Storage Management Appliance
- HP OpenView Storage Provisioner
- HP StorageWorks Business Copy EVA

Hands-on lab activity will reinforce the skills, methods, and sequence of tasks required to successfully implement each of these solutions.

Recommended storage technical training curriculum

Detailed information on each course as well as other storage training materials can be seen at: <http://nsscat.corp.hp.com/materials.htm>.

An individual applying toward a storage certification through the HP Certified Professional (HPCP) program can use most of these courses. Details of the HPCP program can be viewed at: <http://www.hp.com/certification/index.html>.

Course prerequisites

Successful completion of the following courses:

- HP Storage Technologies
- HP StorageWorks Full-line Technical Training
- HP Storage Software and Solutions Full-line Technical Training

OR experience with the preceding technologies and solutions

Successful completion of any one of the following courses:

- Designing and Implementing HP StorageWorks Solutions on Windows NT and NetWare Platforms
- HP StorageWorks for OpenVMS Platforms
- HP Multi-vendor StorageWorks for UNIX Platforms
- Implementing HP Enterprise Virtual Array Solutions

Students should be comfortable with the following before taking this class:

- Fibre Channel concepts including knowledge of arbitrated-loops, switched fabrics, and Fibre Channel hardware components
- Microsoft Windows-based server environment, measured by their comfort in navigating through Windows system management utilities

Course objectives

After completing this course you should be able to:

- Define HP ENSAextended and state its benefits.
- List the applications that belong to the Storage Software product suite.
- State the purpose and benefits of Storage Virtual Replicator.
- Plan, deploy, and configure Storage Virtual Replicator.
- List the installation steps for the Storage Management Appliance.
- List the software applications that are available on the Storage Management Appliance.
- Identify troubleshooting techniques and solutions on the Storage Management Appliance.
- State the purpose and benefits of Storage Provisioner.
- Plan, deploy, and configure Storage Provisioner.
- State the purpose and benefits of Business Copy.
- Plan, deploy, and configure Business Copy.

Course agenda

The course agenda for Implementing HP Storage Software Solutions includes:

- Day 1
 - **Module 1** — HP ENSAextended and Storage Software Overview
 - **Module 2** — HP OpenView Storage Virtual Replicator
 - **Lab 2** — HP OpenView Storage Virtual Replicator
- Day 2
 - **Module 3** — HP OpenView Storage Management Appliance
 - **Module 3A** — HP OpenView Storage Management Appliance Troubleshooting Addendum (optional)
 - **Lab 3.1** — HP OpenView Storage Management Appliance — Installation and Connection
 - **Lab 3.2** — HP OpenView Storage Management Appliance — Functionality
 - **Module 4** — HP OpenView Storage Provisioner — concepts, Installation and Operation
 - **Lab 4** — HP OpenView Storage Provisioner — Installation and Operation
- Day 3
 - **Modules 5** — HP StorageWorks Business Copy EVA — Concepts and Operation
 - **Module 6** — HP StorageWorks Business Copy EVA — Planning and Installation
 - **Lab 6.1** — HP StorageWorks Business Copy EVA — Installation
 - **Lab 6.2** — HP StorageWorks Business Copy EVA — Operation
 - **Course review**

-

HP ENSAextended and Storage Software Overview

Module 1

Objectives

After completing this module, you should be able to:

- Explain what is meant by HP Enterprise Network Storage Architecture Extended (ENSAextended).
- List features for the ENSAextended adaptive infrastructure
- List features of the ENSAextended Active Intelligent Management
- List elements that are managed by the ENSAextended Active Intelligent Management
- Be familiar with HP storage software applications and their function

Enterprise Network Storage Architecture Extended

ENSAextended: Putting you in control

Today's hyper-competitive business climate and challenging economic times are placing heightened pressure on organizations to cut costs, increase revenues, and deliver value to shareholders. Business leaders consider their information technology (IT) infrastructure an invaluable asset and a critical part of their day-to-day operations. Consequently, IT managers are faced with a growing demand to build and maintain an infrastructure that is cost effective, highly reliable, and predictable—yet still adaptable to change. In addition, many IT infrastructures are so complex and difficult to manage that IT managers must gain greater control over their environment to stay competitive.

Today, every organization faces economic realities that threaten their viability, including:

- Volatile business world — markets and customers are unpredictable
- More competitive pressure — new competitors emerge every day to challenge the market position of an organization
- IT budgets and resources that react to business pressures — opportunities for business expansion conflict with IT budget constraints

A survey by the Giga Information Group reveals that today's CIOs are most concerned with the following issues:

- Cutting/stabilizing costs
- Aligning IT investments with business directions
- Building strong IT service delivery
- Selective outsourcing
- Managing resources
- Security
- Enterprise architecture
- Integrating systems
- Boosting credibility of the value of IT services
- Planning in order to prioritize IT investments

The needs of CIOs are clear: cut IT costs, reduce IT complexity, and maximize IT resources (hardware, software, network, and human capital). It is time for the storage industry to deliver a blueprint that addresses these needs.

What is ENSAextended?

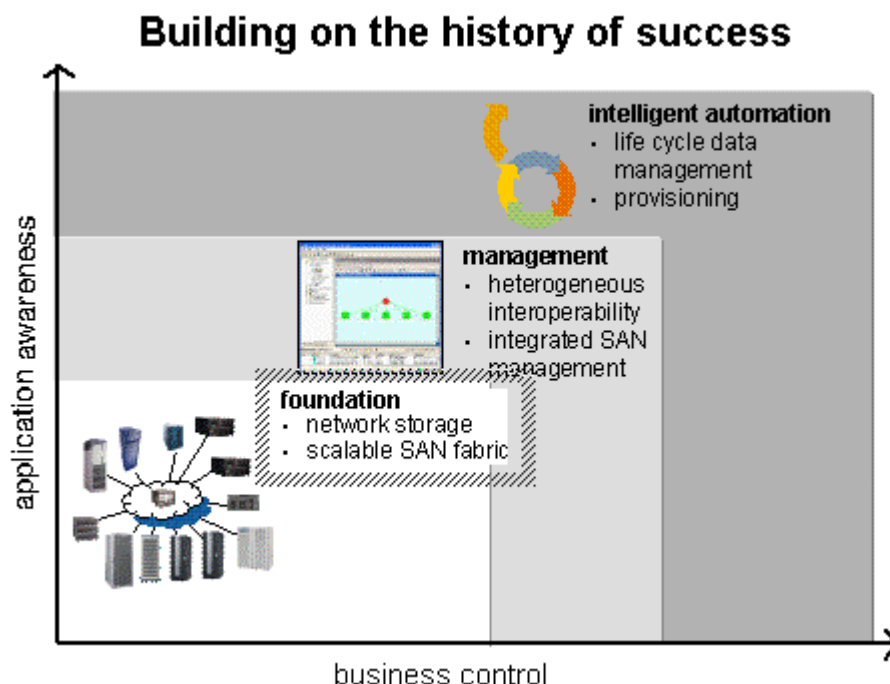
- Blueprint for HP storage development for next 3-5 years
- Builds upon the work already accomplished
 - Storage that is modular, scalable, and highly available
- Next phase of network storage—the adaptive storage infrastructure



ENSAextended is an extension of the HP ENSA. The blueprint for the adaptive storage infrastructure, ENSAextended puts businesses in control of their storage environment, allowing them to control complexity, uncertainty, and risk. With this control, they gain efficiency, confidence, effectiveness, and ultimately business agility. Although ENSAextended is a forward-looking blueprint, it builds on years of successful innovation and consistent delivery of network storage solutions to the market. The original ENSA was revolutionary; ENSAextended is the evolution of the storage utility vision.

Building on the storage utility

Introduced in 1998, ENSA described a revolutionary vision for a storage utility: IT would deliver the right information anywhere, anytime. This vision required a fundamental shift from a direct attached storage (DAS) infrastructure to a networked environment in which storage could be configured and managed as a consolidated resource for the entire computing environment. In 1998, networked storage was still a radical idea. Since then, it has become widely accepted, and the industry is rapidly developing it.



The ENSA blueprint specified that network storage must be modular, scalable, and highly available. These three guiding principles drove the development of numerous solutions that changed the industry, including the following:

- 1998 — Disk and tape on the same SAN; SAN-based backup and recovery
- 1999 — SAN-based data replication
- 2000 — SAN-based storage management; SAN storage allocation reporting; metro-wide SAN data movement
- 2001 — Open SAN supported solutions; DAS-to-SAN (DtS) technology; storage utility management; VersaStor virtualization technology in the Enterprise Virtual Array; key concepts such as the global replication network and universal network storage

ENSAextended: Extending the storage utility

Delivering the storage utility continues to be the guiding vision for HP storage. Now that the key foundational elements of network storage defined in the original ENSA blueprint are widely deployed, a new blueprint is required to bring development efforts even closer to the storage utility vision.

ENSAextended is the blueprint for HP storage development over the next three to five years. As the name suggests, ENSAextended builds on the work HP has already accomplished over the last half-decade, bringing the industry to the next phase of network storage—the adaptive storage infrastructure.

Adaptive storage infrastructure

For the customer to implement a storage utility, a comprehensive infrastructure must be in place—one that is transparent to the customer yet able to manage the details essential to delivering the required level of service. The adaptive storage infrastructure will allow businesses not only to quickly respond to these challenges, but also to outpace them in the future.



**Delivering the
adaptive infrastructure for
storage**

Controllable

- Manageable and measurable
- Quality of service
- Business rule driven

Resilient

- Predictable
- Automated recovery
- Self-healing & tuning

Extensible

- Open modular storage
- Flexible and scalable
- Application aware

An adaptive storage infrastructure must be:

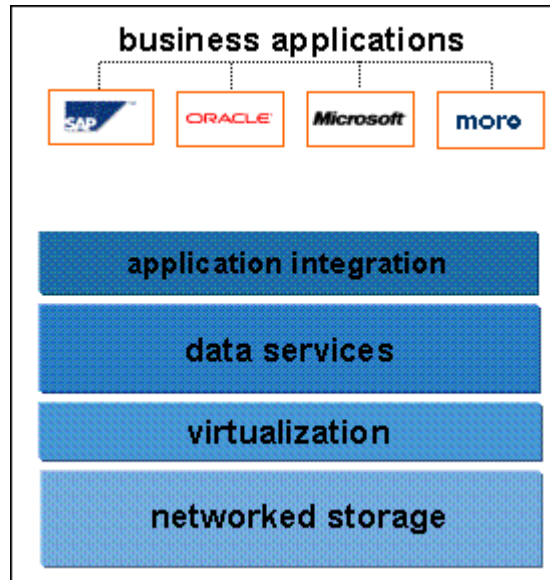
- **Controllable** — Easily and centrally manageable, with the ability to monitor and measure performance, delivering pervasive automation driven by business rules defined by the administrator, and offering control over Quality of Service (QoS) requirements
- **Resilient** — Highly reliable and predictable, with automated recovery and features including self-healing and self-tuning
- **Extensible** — Modular in design and scalable in geography, capacity, and performance, with universal interoperability and the ability to extend from storage to business applications (application-aware)

Example:

As a business nears the end of its fiscal year, orders, sales, expenses, and profit analysis become paramount, placing significant stress on the IT infrastructure. Using rule-based management, the critical applications associated with these functions can be given a higher priority and dynamically moved to higher performing resources, and greater capacity can be dynamically allocated to adjust to this part of the business cycle—thanks to the adaptive storage infrastructure.

ENSAextended architecture

The following figure shows the high-level blueprint of the ENSAextended architecture. It shows the primary building blocks that will drive the development of HP StorageWorks hardware and OpenView storage software in the years to come.



At the core of the adaptive storage infrastructure are three foundational elements: networked storage, virtualization, and data services.

Networked storage

Networked storage includes storage arrays, network-attached storage, tape libraries, network switching, and host bus adapters, which are the physical components of the adaptive storage infrastructure. HP has a comprehensive offering of these network storage solutions today. In the future, these foundational elements will be enhanced by self-diagnosing and self-healing capabilities that will further enhance their resiliency. Self-diagnosing and self-healing hardware and software ensure high availability with minimal manual intervention.

Example:

IT designers can create the amount of redundancy and managed resiliency required for each business application. The self-repairing capability of networked storage is transparent to applications, and administrator involvement—only required to replace failed or worn components—can be accomplished in a planned manner rather than a reactive one.

Virtualization

Virtualization, a storage abstraction, vastly improves storage capacity utilization and simplifies storage management. It unifies heterogeneous arrays in the SAN and provides a single large storage pool. This pool is accessible by all the servers and applications that are part of the network, enabling higher utilization of available disk space and offering the flexibility to choose and deliver QoS parameters, such as performance, availability, and protection.

Today, HP offers the most comprehensive offering of virtualization solutions in the industry. As the ENSAextended architecture diagram suggests, future virtualization technology will permeate the entire foundation of network storage products.

Data services

Data services contribute significantly to overall resiliency and data service-level delivery. Today HP offers a leading portfolio of solutions. In the OpenView data management software, solutions include instant recovery, data protection, and data archiving. StorageWorks device software provides data replication and migration, multi-pathing and failover, and performance optimization.

Example:

The administrator pre-allocates, or “provisions” capacity to individual users and applications. Users can draw additional capacity up to their prescribed limits. This process allows the administrator to shift their focus from watching individual users to monitoring overall storage utilization—and adding infrastructure as needed.

Even the most reliable storage system will need to be taken offline eventually. In an adaptive infrastructure, application data can be migrated from the storage system to a new system without any application disruption, and it can be migrated to higher-performing systems during peak operations.

Application integration

Application integration is the component of ENSAextended that considers the needs of business applications and focuses on creating an adaptive storage infrastructure that is application-aware in order to create unsurpassed storage solutions that directly align with the needs of the business. Business-critical applications such as Enterprise Resource Planning (ERP) software, Customer Relationship Management (CRM) software, sales and order systems, e-commerce applications, and e-mail systems are the backbone of enterprise operations. Each of these applications requires high levels of service as well as individual administration.

An adaptive infrastructure that is application-aware allows greater responsiveness to changing requirements such as point of access, access speed, and throughput.

HP has a long history of working closely with companies such as SAP, Oracle, Microsoft, and others to better integrate with their business applications.

Example:

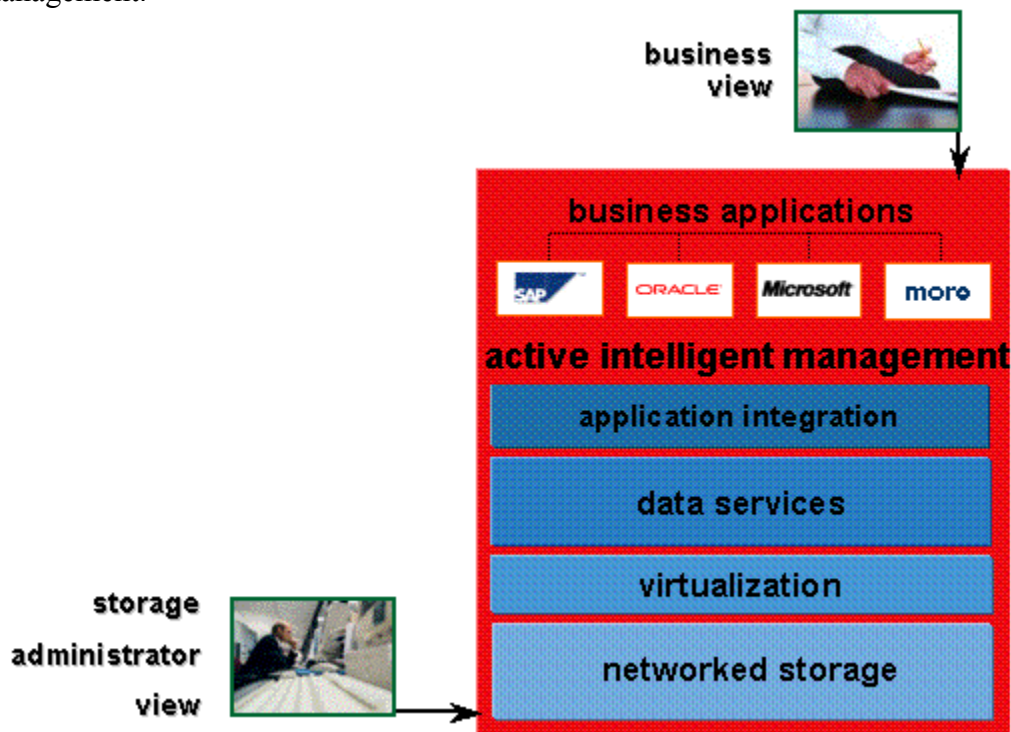
An integrated Oracle database application crosses a capacity threshold as its size nears the capacity of the pre-allocated volume for the database. The database sends a message to the management software that follows a pre-established set of rules and dynamically expands the size of the Oracle database.

Views

ENSAextended introduces two customer perspectives of the storage infrastructure: a system administrator view and a business application view. Typically, storage vendors pay close attention to the needs of the system administrator, but little, if any, attention to the needs of the application user. Enhancing the already robust offering of HP system administrator tools, ENSAextended also focuses on delivering an adaptive storage infrastructure that is application-aware for true end-to-end storage to business application solutions.

Active intelligent management

The most significant element of the ENSAextended architecture is active intelligent management because it is what binds the other elements together into a manageable and controllable network storage environment. Active intelligent management gives storage administrators the tools necessary to consolidate and simplify the management of storage resources and information. It performs these services in direct alignment with business objectives—from storage to the application. The key elements of active intelligent management are integrated storage resource management, data access management, and lifecycle data management.



Example:

Data is collected for a marketing analysis various real-time reports are generated. Approximately six months later, the data no longer needs to be easily accessible, but it must stay easily retrievable. Six months beyond that, the data can be archived. Based on business-based policies, active intelligent management can automatically move this data from high-performance, high-availability storage to medium-performance, good availability storage and, eventually, to bar-coded tape.

By automating storage management tasks, HP reduces the complexity and the cost of maintaining storage and growing your IT resources. Simplifying the administrator's role shifts attention from day-to-day issues to more strategic and business-related issues. Now you are in control with lower management costs, higher employee productivity, and greater application uptime. Better service with fewer resources and lower costs--ENSAextended.

Software

Software provides the active intelligent management for ENSAextended.

| | |
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| | <p>Note: Refer to the HP Storage Software website for the latest available software.</p> |
|--|---|

The remainder of this module gives an overview of HP's storage software available at the time of printing of this document and organizes the software in the same categories used on the Storage Software website.

Storage area management software

Open View Storage Area Manager

HP OpenView Storage Area Manager (OV SAM) software simplifies and automates the management of your storage resources and infrastructure. It manages tape and disk, direct attached and network storage, across multi-vendor devices, operating systems, and distributed environments. From its central management console it allows you to effectively monitor and manage storage and storage service availability, performance, usage, cost, and growth, helping you to gain control of your storage while optimizing resource utilization and cost.

The OpenView Storage Area Manager software suite consists of five components, enabling seamlessly integrated storage resource and infrastructure management.

Storage Allocator

HP OpenView Storage Allocator allows you to build and manage complex storage networks of heterogeneous servers and storage devices. Its intuitive user interface enables you to conveniently and confidently assign storage to one or more hosts and be assured that only specified hosts have access. Further, you can view storage and nodes and manage the entire storage network from one central console, managing hundreds of storage logical unit numbers (LUNs) and hosts as a single storage network, to increase the efficiency of your department.

Storage Accountant

HP OpenView Storage Accountant provides you with a toolset to centrally measure storage assigned to users for financial analysis, budgeting, and charge-back. It helps you control storage costs and increase revenue from providing storage services. Storage Accountant also allows you to differentiate your service offerings to better meet the demands of your customers.

Storage Optimizer

HP OpenView Storage Optimizer provides real-time performance monitoring of your entire storage network—including hosts, infrastructure, and storage—all from a single management console. With Storage Optimizer you can receive automatic notification of impending performance problems before they become serious, and you can track performance metrics over time so you never get caught short by demand.

Storage Builder

HP OpenView Storage Builder is a resource-planning and inventory tool for direct attached, SAN attached, and network attached storage. It displays storage allocation and utilization by host, storage device, LUN, partition, volume, directory, and user. Coupled with comprehensive reporting, historical trending and future extrapolation capabilities, Storage Builder enables effective and reliable capacity forecasting.

Storage Node Manager

HP OpenView Storage Node Manager helps you understand, plan, and manage direct attached and networked storage across the distributed enterprise. Acting as a central management console, Storage Node Manager provides storage network status and event monitoring through an easy-to-read topology map that displays devices and their physical and redundant connections, including the representation of zones.

OpenView Storage Provisioner

HP OpenView Storage Provisioner is a tool that assists storage administrators in providing storage as a utility. This tool allows administrators to establish multiple storage offerings based on service levels and storage attributes. These offerings can then be made available to users based on their needs.

Storage Provisioner minimizes the repetitive and time-consuming steps involved in manual storage provisioning, thus enabling administrators to focus on higher-level tasks. Requests for additional storage can be satisfied immediately, eliminating costly delays associated with having to manually reconfigure existing arrays.

By providing a current and accurate view of available storage, Storage Provisioner eliminates the potential for over-purchasing and over-allocating valuable storage resources. Eliminating repetitive manual processes decreases the potential for errors and associated down time.

OpenView Storage Management Appliance

The Storage Management Appliance, along with HP OpenView Storage Management Appliance software, provides a centralized point for managing and monitoring SAN elements—including switches and storage devices—to simplify management tasks and reduce management costs. This unit is an appliance that connects directly to the SAN fabric or storage network layer and performs management functions without using a host computer. This host-independent approach preserves valuable application processing cycles while accommodating different computing platforms in an open SAN environment.

Device and configuration management software

StorageWorks Command View XP

HP StorageWorks Command View XP provides centralized, web-based management for XP disk arrays.

The Command View common user interface, from which all management applications and tasks are launched, reduces the learning curve of your staff and increases the time available to focus on your business needs. The web-based architecture of Command View enables administrators to simultaneously view the same information simply by launching a web-browser, which provides an excellent training tool for your staff.

StorageWorks Command View EVA

HP StorageWorks Command View EVA provides the web-based management interface for VCS and HSV1xx array controllers and is included with the HP OpenView Storage Management Appliance. Up to 16 EVA storage systems (16 HSV1xx controller pairs) can be managed by a single HP OpenView Storage Management Appliance.

StorageWorks Command View Storage Device Management

HP StorageWorks Command View Storage Device Management (SDM) software enables you to manage an unlimited number of HP virtual arrays from a graphical user interface (GUI), command line user interface (CLUI), or web browser. From a simple management console you can launch and configure additional virtual array software, such as HP Secure Manager, Business Copy, and Auto Path Virtual Array packages. Command View SDM supports the entire HP virtual array family and future HP networked modular storage products.

StorageWorks Secure Manager XP

HP StorageWorks Secure Manager XP provides controlled access to data stored on your XP disk array by preventing unauthorized servers from accessing your data. It ensures seamless data security for all host environments supported by XP arrays. This product is supported on the xp512 and xp48 disk arrays only.

StorageWorks LUN Configuration Manager XP

HP StorageWorks LUN Configuration Manager XP simplifies array management tasks by providing easy-to-use menus for defining array groups, setting up logical volumes, and configuring fibre channel ports. This product is available for the XP512 and XP48 only.

StorageWorks LUN Configuration and Security Manager XP

HP StorageWorks LUN Configuration and Security Manager XP provides convenient LUN management and data security for the XP128 and XP1024 disk arrays. It allows for LUN size expansion and volume size configuration. It also provides controlled, secure access to data stored on your XP disk array by preventing unauthorized servers from accessing your data. It ensures seamless data security for all host environments supported by the XP128 and XP1024 disk arrays.

Array Configuration Utility XE (for MSA)

The HP Array Configuration Utility (ACU) XE software for Smart Array controllers makes it easy to configure and expand your disk drive arrays. This web-based tool is very intuitive using its configuration wizards to set-up your array controller. ACU XE is also very versatile allowing you to locally or remotely configure your array controller, add additional disk drives to an existing configuration, or completely reconfigure your disk drive array. Additionally, innovative features such as Online Capacity Expansion, Logical Drive Capacity Extension, and RAID Level Migration allow you to change your array configuration and settings as your storage needs change.

Performance management software

StorageWorks Performance Advisor XP

HP StorageWorks Performance Advisor XP is a web-based application that collects and monitors real-time performance of XP disk arrays, either as a stand-alone tool or integrated with Command View XP. Web-based performance monitoring can be used almost anywhere to check the status of your XP array, and a CLUI is also provided to integrate into third-party packages. Performance Advisor XP enables you to monitor many-to-many hosts to arrays from a single management station.

StorageWorks Application Policy Manager

HP StorageWorks Application Policy Manager is a performance allocation tool for XP disk arrays. It lets you align IT priorities with storage performance resources and allows these resources to be intelligently allocated to hosts. You can prioritize critical systems by ensuring that they have all the XP disk array performance they need to meet business objectives. You can also ensure that business processes (such as backups and data warehouse loads) get the array bandwidth necessary to meet deadlines. Application Policy Manager enables sophisticated service provider solutions based on distinct performance levels of service.

Because it ensures that array resources are used optimally, Application Policy Manager maximizes the return on investment (ROI) on your XP solution. It has a rich feature set for flexible policy definition, scheduling, monitoring, and analysis; and it works with HP StorageWorks Command View XP, ensuring secure Web-based management.

Application Policy Manager is a product suite for XP128 and XP1024 disk arrays only, combining LUN configuration and security into a single integrated product. It makes it easy to add and delete paths, set host mode, configure Fibre Channel ports, and create and release LUNs. It also allows for the creation of expanded volumes as well as smaller volumes. Backing up all this functionality is high-level security that protects your data from unauthorized access. Every I/O is checked to verify and validate proper security to insure your data is safe.

StorageWorks Auto LUN XP

HP StorageWorks Auto LUN XP provides automatic monitoring and workload balancing for your XP disk arrays. It allows you to move frequently accessed data to underused volumes, replicate volumes for backup and recovery, and view the health of your array. You set the goals, Auto LUN XP proposes a migration plan and simulates the expected results. You then approve the plan.

StorageWorks Cache LUN XP

HP StorageWorks Cache LUN XP speeds up access to mission-critical data. For an e-commerce site, a business-to-business portal, or large databases, the rapid flow of information is important. Cache LUN XP is very important for heavily accessed LUNs, like database logs or index files. Cache memory for Cache LUN XP can be set as low as one logical block or as high as 512MB.

OpenView Storage Optimizer

HP OpenView Storage Optimizer is one of the components of OV SAM and a summary of its functions is listed under OV SM.

Information lifecycle management software

OpenView Storage Data Protector

To protect your business-critical information from any risk of loss, HP OpenView Data Protector provides industry-leading Instant Recovery capabilities based on mirroring and snapshot technologies that use disk as a recovery media rather than tape. Using disk-based recovery, Data Protector enables the recovery of terabytes of data in minutes, rather than hours.

To achieve optimum IT efficiency, data protection services must be integrated and managed as an integral component of the overall IT service. Data Protector enables service-driven management through seamless integration and allows data protection to be managed as a set of services rather than a set of individual tasks or technologies. IT managers gain confidence in knowing that the storage elements on which their services depend are actively and efficiently managed.

Data Protector builds on the capabilities of its predecessor, HP OpenView Omniback II, and is fully compatible with existing Omniback II tapes, scripts, and procedures.

OpenView Storage Media Operations HP OpenView Storage Media Operations is a software product that provides tracking and management of offline storage media, such as magnetic tapes, resulting in more reliable backups, faster data recovery, improved staff efficiency, and reduced costs.

Media Operations offers a professional solution for IT operations that manage thousands of removable media. It tracks all media whether online, offline, or offsite, ensuring that vital data is never lost. Data retention and media recycling policies are enforced for assured service quality. To guarantee backup success, Media Operations monitors media quality and preloads libraries with sufficient scratch tapes.

Designed in partnership with data center staffs, Media Operations maximizes the effectiveness of media procedures by creating daily task lists, organizing tapes for logical data center walkthroughs, and enabling operator control of tape libraries, barcode scanners, and media label printers.

Replication software

OpenView Continuous Access Storage Appliance

The HP OpenView Continuous Access Storage Appliance is a replication appliance delivering capabilities to increase business revenue and productivity. High availability features such as local and remote replication or snapshots enable businesses to quickly recover from natural (flood, earthquake) or manmade (virus, hacker, operator error) disasters. Physical storage is collected into logical pools. Through pooling, stranded capacity can immediately provide additional capacity and reduce upfront storage costs.

OpenView Storage Virtual Replicator

HP OpenView Storage Virtual Replicator server-based virtualization enables you to erase the physical boundaries of your storage units and provide flexible, simplified storage management for Microsoft Windows environments. You can consolidate physical storage into a pool of capacity. That capacity can be provisioned to applications and users by creating large virtual disks tailored to the specific production environment requirements.

Storage Virtual Replicator allows you to create instant, space-efficient snapshots for multiple purposes. For example, a snapshot allows you to perform backups and restores with minimal impact to users and applications. The Online Volume Growth feature enables you to expand a virtual disk or a basic disk on Windows 2000 without rebooting.

Storage Virtual Replicator reduces backup and restore windows from hours to minutes, improving data and application availability, maximizing utilization of resources and reducing the cost and complexity of managing storage. It uses industry-standard components, protecting current and future storage investments. Virtualized Storage Management for Exchange 2000 and SQL Server 2000 are fully integrated and tested solutions based on Storage Virtual Replicator.

StorageWorks Business Copy XP

With HP StorageWorks Business Copy XP, you can more effectively leverage critical business data by creating multiple real-time online copies without adversely impacting primary production operation. Business Copy XP enables a wide range of critical enterprise applications and solutions, including zero-downtime split-mirror backup, disaster recovery mirroring, decision support, and application development and testing.

StorageWorks Business Copy EVA

HP StorageWorks Business Copy EVA is a local replication software product for the Enterprise Virtual Arrays 3000 and 5000 providing snapshot and snapclone set-up and management. Business Copy EVA creates point-in-time copies of storage volumes using the snapshot and cloning capabilities of the array firmware and provides multi-array local mirror management.

Business Copy EVA combines the former VCS snapshot product license with an improved management capability, formerly known as Enterprise Volume Manager (EVM), into a single orderable product. Additional features of the new product include licensing based on replicated (not total raw) capacity and an improved management interface.

The Business Copy Upgrade UI EVA is a product designed to allow current EVA VCS snapshot customers who do not own EVM to add the new graphical interface to enable multi-array mirror management.

The functionality for local replication or point-in-time copy creation of storage volumes resides within the array firmware. Local replication can be implemented by means of two methods. Business Copy provides Basic and Enhanced levels of replication. Each generates or automates Business Continuance Volumes using the snapshot and cloning capabilities residing within the array firmware. The differences lie in the degree of automation of the process and the ability to use scripts to implement the process.

StorageWorks Business Copy VA

HP StorageWorks Business Copy Virtual Array is an array-based data replication tool for HP virtual arrays that eliminates data movement between the host and storage device, allowing users to create nearly instant business copies for online backup or application testing. Business Copy VA can create local copies of any active application volume on the VA 7100 or 7400 for use by other applications or systems for batch processing, backup, or testing without interrupting your current workflow.

StorageWorks Continuous Access EVA

HP StorageWorks Continuous Access EVA (CA EVA) is a controller-based application that performs real-time replication between HP StorageWorks enterprise virtual arrays. The solution is enhanced to perform remote replication and deliver high data availability and performance to users on Fibre Channel based campus, metro, or continental storage area networks.

CA EVA provides you with the highest level of storage data protection capabilities to meet your business continuity implementation goals. You can achieve a competitive advantage by combining disaster-tolerant solutions and disaster-tolerant managed services into your planning and daily routines, ensuring the security, availability and integrity of your data.

CA EVA delivers local copy with snapshot Virtual Controller Software and virtualization interoperability to protect against disaster-like scenarios, saving time and money while maintaining the flow of information across the enterprise.

StorageWorks Continuous Access XP and XP Extension

HP StorageWorks Continuous Access XP and XP Extension are high-availability data and disaster recovery solutions that deliver host-independent real-time remote data mirroring between XP disk arrays. With seamless integration into a full spectrum of remote mirroring-based solutions, Continuous Access XP and XP Extension can be deployed in solutions ranging from data migration to high availability server clustering and is available using ESCON or fibre channel.

Multi-pathing software

StorageWorks Secure Path

HP StorageWorks Secure Path is a family of high-availability multi-pathing software products providing continuous data access from an HP RAID array to host servers running HP-UX, Windows, Linux, Sun Solaris, Novell NetWare, or IBM AIX operating systems.

Redundant hardware, advanced RAID technology and the Secure Path automated failover capability are used to enhance fault tolerance and availability. Secure Path effectively eliminates controllers, disk drives, interconnect hardware and host bus adapters as single points of failure in the storage subsystem.

StorageWorks Auto Path XP and VA

HP StorageWorks Auto Path is server-based software that provides I/O path failover and load balancing for both the XP and VA disk arrays. It helps provide a fault-tolerant infrastructure to avoid data stoppages or catastrophic halts.

Business continuity software

StorageWorks Cluster Extension XP

HP StorageWorks Cluster Extension XP continues your critical applications within minutes or seconds after an event. It offers disaster tolerance against application downtime from fault, failure, or site disaster by extending clusters between data centers. Cluster Extension XP works seamlessly with your open-system clustering software and XP storage systems to automate failover and failback between sites.

Virtualization software

OpenView Continuous Access Storage Appliance

The HP OpenView Continuous Access Storage Appliance was summarized under replication software.

OpenView Storage Virtual Replicator

The HP OpenView Storage Virtual Replicator software was summarized under replication software.

Platform software

StorageWorks XP disk array software

In addition to the XP software summarized earlier in this module, HP also offers the following XP software.

StorageWorks Resource Manager XP and Data Exchange XP

HP StorageWorks Resource Manager XP allows an XP array to connect to a mainframe system by means of an ESCON link. HP StorageWorks Data Exchange XP allows you to share information across your computing platforms. Together, these products free your network of host-to-host data conversion traffic. You can move to a consolidated network storage solution, providing for connectivity to mainframes and allowing data exchange between mainframes and open systems.

StorageWorks Direct Backup solution for XP

The HP StorageWorks Direct Backup solution for the Disk Array XP family is designed to provide more efficient backup within a SAN for enterprise customers with mission-critical applications. Tightly integrated with Business Copy XP, Direct Backup solution for XP and backup software products enable back up of data directly from the disk array to the tape library within a SAN.

The Direct Backup solution utilizes Business Copy XP to make a point-in-time copy of the data. The data movement of the copy to tape is performed through the Direct Backup Engine. A data mapping function from the backup software products provides the mapping of the data through the various software and system layers that enable faster restore of the data from tape within the application or database.

StorageWorks Fast Recovery solutions

HP StorageWorks Fast Recovery solutions (FRS) enable quick recovery of Exchange databases. Using the Business Copy or Continuous Access secondary volume, FRS can recover these databases in minutes rather than hours.

StorageWorks Data Integrity Check

HP StorageWorks Data Integrity Check provides the XP disk array with an added level of data protection when deployed in Oracle database environments. It helps customers avoid data corruption-related downtime and ensure business continuity.

StorageWorks EVA software

In addition to the EVA software summarized earlier in this module, HP also offers the following EVA software.

SmartStart Scripting Toolkit

The SmartStart Scripting Toolkit can be run from the EVA and is a server deployment product that delivers an unattended automated installation for high volume server deployments.

StorageWorks Virtual Controller software

HP StorageWorks Virtual Controller software (VCS) provides storage controller software capability for the Enterprise Virtual Array.

StorageWorks VA software

In addition to the VA software summarized earlier in this module, HP also offers the following VA software.

StorageWorks Secure Manager VA

HP StorageWorks Secure Manager Virtual Array enables you to set LUN permissions within the array to protect your most sensitive data. It guards against LUNs being deleted by unauthorized servers or users. Secure Manager Virtual Array supports up to 128 host bus adapters and worldwide names and up to 128 secure LUNs on the HP Virtual Array 7100 or up to 128 LUNs on the HP Virtual Array 7400.

StorageWorks Fast Recovery solutions

HP StorageWorks Fast Recovery solutions (FRS) enable quick recovery of Exchange databases. Using the Business Copy or Continuous Access secondary volume, FRS can recover these databases in minutes rather than hours.

StorageWorks Modular Storage Array 1000 family software

The MSA 1000 software was summarized earlier in this module.

StorageWorks MA/EMA family software

In addition to the MA/EMA software summarized earlier in this module, HP also offers the following MA/EMA software.

StorageWorks Command Scriptor (for HSG)

The HP StorageWorks Command Scriptor application software provides experienced IT managers with command-level control of HP StorageWorks systems equipped with HSG60, HSG80, HSZ70, and HSZ80 Array Controllers. Command Scriptor works in a heterogeneous host environment that includes Tru64 UNIX, Windows 2000, Windows NT, Sun Solaris, OpenVMS, IBM-AIX, and HP-UX.

With Command Scriptor, IT managers can create, edit, and run script files that contain StorageWorks command line interpreter (CLI) commands to automate frequently performed StorageWorks operations.

Command Scriptor was developed in response to customer requests for an easy-to-use, command-level control tool for array controllers. Designed for the experienced IT manager, Command Scriptor provides flexibility by allowing you to connect through a web-based interface or directly to the array controllers.

StorageWorks Command Console (for HSG)

HP StorageWorks Command Console is an easy to use, graphical storage configuration and monitoring software tool for HP StorageWorks MA8000/6000, ESA12000, EMA12000, EMA16000, and RA8000 RAID arrays. It reduces the job of storage management to simple point-and-click and allows system administrators to configure and monitor storage graphically from a single management console.

Aimed at businesses with large storage requirements, Command Console optimizes the time of administrators by unifying management tasks under one common umbrella. It also has distributed capabilities that allow administrators to view multiple servers at the same time in a Microsoft Explorer-like navigation pane.

The StorageWorks Command Console client is a GUI that can configure and monitor MAs/EMAs. This client runs on Windows NT 4.0 or Windows 2000.

Agents for Command Console are provided for a variety of host systems. Each agent runs on the host system and communicates with the client over a TCP/IP network connection, a SCSI connection, or a serial connection.

StorageWorks Data Replication Manager (for HSG)

Data Replication Manager (DRM) MA/EMA is an ideal solution for mirroring data online and in real-time to remote locations by means of a local or an extended SAN. Using DRM software on MA/EMA storage systems, data replication is performed at the storage system level and in the background to any host activity.

The StorageWorks RAID Arrays running DRM can replicate data up to 100km using direct Fibre Channel links at full Fibre Channel speeds (100MB/sec.), connect their SAN islands via a fiber optic Wave Division Multiplexing in a Metro public or private network, or go unlimited distances with Fibre Channel over IP networks and Fibre Channel-to-ATM gateways. DRM gives you the widest choice of communication networks, bandwidth, distance, and availability options to best meet your enterprise-level network storage requirements. StorageWorks Array Controller Software

StorageWorks HSG Element Manager

HP StorageWorks HSG Element Manager provides an easy to use, graphical storage configuration and monitoring tool that centralizes storage management across network and multi-vendor platforms. Included with the HP OpenView Storage Management Appliance, HSG Element Manager reduces the job of storage management to simple point-and-click, across the switched Fibre Channel SAN. It provides for easy configuration of HP StorageWorks HSG80/60 storage systems as well as field replaceable unit (FRU) level fault detection and notification, by means of an SNMP agent with MIB event logging.

StorageWorks Array Controller software

HP StorageWorks Array Controller software (ACS) provides storage controller software capability for the MA8000/EMA12000/EMA16000 while also providing software upgrades to the retired RA8000/ESA12000 and MA6000 product families.

StorageWorks Business Copy Upgrade UI MA/EMA

Although no longer listed on the HP Storage Software website, Business Copy Upgrade UI MA/EMA is a product for current MA/EMA customers with the appropriate controller software versions who want the new graphical interface to manage the creation of clones or snapshots.

Learning check

1. You have been asked by a customer to explain what HP means by the term ENSAextended. How would you answer this question?

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2. For an adaptive storage infrastructure to allow businesses to rapidly adapt to ever-changing needs, it must be _____?

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3. List the three foundational elements at the core of the adaptive storage infrastructure.

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4. Name the extended technologies used by the adaptive storage infrastructure.

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5. Name three of the five OpenView Storage Area Manager components.

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6. List the two information lifecycle management (data protection) software products.

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7. Describe the purpose of StorageWorks Continuous Access.

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HP OpenView Storage Virtual Replicator

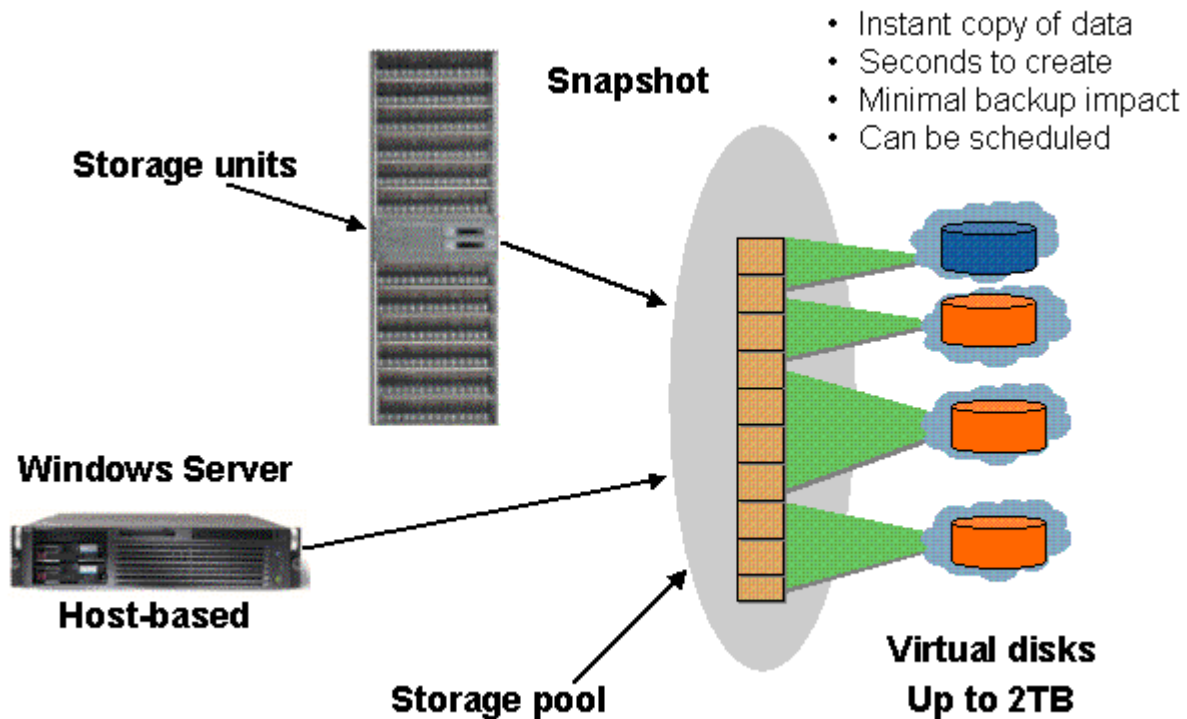
Module 2

Objectives

After completing this module, you should be able to:

- Describe the purpose, features, benefits and functions of HP OpenView Storage Virtual Replicator
- Define the terms storage unit, storage pool, and virtual disk and demonstrate the ability to create and manage each
- Describe the purpose, features and functions of a snapshot, describe its business value, and explain how to create and manage a SVR snapshot.
- Identify the value of online volume growth and explain how it is implemented in a Microsoft Windows environment
- Describe the additional support provided by SVR
- Identify the tools used to manage SVR and explain their functions.

Overview



With Storage Virtual Replicator, you can pool physical storage and create virtual disks up to 2TB in size. Virtual disk space can be allocated as needed. With storage pooling and virtualization, you can respond quickly to changing storage capacity requirements.

Storage Virtual Replicator enables you to create a near instantaneous point-in-time replica of production data – without incurring the time and performance issues normally involved with a block-by-block copy or backup procedure. This “virtual copy” is referred to as a snapshot, and looks exactly like the original disk from which it was created. The resulting snapshot can be used to perform a variety of functions with minimal impact to the user’s ability to access production data and applications.

You can schedule automated snapshot backups using the integrated policy-based scheduling and scripting features.

Storage Virtual Replicator tools are accessible through either the MMC or a command line interface.

Storage Virtual Replicator allows you to:

- Group hardware arrays or physical disks to form a large pool of storage.
- Divide the pool into virtual disks from 10MB to 2TB in size.
- Make instant copies (snapshots) of a virtual disk.
- Use virtual disks and snapshots on your local computer.
- Add non-disruptive virtualization of storage devices with the existing production data imported into a pool.
- Ability to defrag virtual disks to increase I/O performance.
- Ability to assign virtual disks as volume mount-points for snapshots.
- Backup only those files that have changed since the last backup.
- Ensures adequate pool space is reserved to accommodate volume growth and snapshot operations.

Benefits

The following items indicate how a typical enterprise can benefit from Storage Virtual Replicator:

- **Optimize disk storage by using storage pooling and virtualization**

Physical disk storage can be centralized, taking advantage of storage subsystems that provide higher levels of performance and greater degrees of availability. After the storage is centralized, Storage Virtual Replicator can be used to combine all of the physical storage into a pool and then create virtual disks that provide the exact amount of storage a particular server requires. If a server needs more space, storage could be easily adjusted by adding more disk space to the pool.
- **Add storage capacity by growing volumes using Windows basic disks without rebooting**

Storage Virtual Replicator allows you to determine when and where additional physical storage is needed. When a disk is added to a pool, Storage Virtual Replicator directs the operating system to update the internal size of the pool. Then, without requiring a reboot, you can expand the sizes of virtual disks in the pool.
- **Import existing storage units with production data**

An existing storage unit can be added to a pool. The data partition is preserved as a virtual disk and the unused capacity is added to the pool.
- **Use snapshots to back up your data whenever you want**

You can create a snapshot of production data files that is then used for backup without a limited backup window. If an application needs to be quiesced or placed into hot backup before being backed up, you can restart the application as soon as the snapshot is created.
- **Use snapshots to keep data online and perform quick file restores**

In addition to standard backup procedures, snapshots can be used to perform quick restores of user data if necessary.

- Use snapshots to test applications
Create a snapshot of your production data that developers can use to test a new version of the application software before applying an upgrade in the production environment.
- Use snapshots with data mining applications
Snapshots of production data can be used for data mining applications without taking data offline to make a physical copy. Using the snapshot, the data mining application can extract data with no significant impact on production data.
- Predict the amount of physical space that snapshots will consume
The Snapshot Planner feature provides recommendations based on actual system usage. To be effective it must be run before setting up pools and virtual disks.
- Use Storage Virtual Replicator tools to manage your environment remotely
The tools provided with Storage Virtual Replicator let you manage local or remote computers or clusters from a single location. For example, you can create a virtual disk, map a drive letter to it, and format it, all from a remote computer.
- Use in a cluster environment
When installed in a cluster, the Storage Virtual Replicator management tools automatically create cluster resources, simplifying cluster management.
- Use the scheduling wizard to automate repetitive tasks
Automated snapshot backups can be scheduled using the integrated policy-based scheduling and scripting features.

Storage Virtual Replicator Terms

Storage units



A storage unit can be created from physical disks or from a logical device created from a controller-based, fault-tolerant drive array. The disk space on the storage unit is donated to a pool.

Note

The term storage unit is used instead of disk to help distinguish it from the virtual disks you create in the pool that stores your data.

- The largest capacity storage unit that can be included in a pool is 1TB.
- The maximum number of storage units per storage pool is eight.
- A storage unit can be assigned to only one storage pool at a time.

Storage pools

Storage Virtual Replicator enables the grouping of hardware array storage or physical disks into a logically concatenated pool. Any storage accessible by Windows Disk Management can be used in a storage pool.

When deciding which storage units to use in a pool, consider:

- The largest storage unit capacity that can be included in a pool is 1TB.
- A pool can contain up to eight storage units, which can have different capacities and can be from different manufacturers.
- The maximum pool size is 8TB (eight storage units up to 1TB each).
- Storage units used to create a new pool must be 'raw' storage--unpartitioned and must not initially contain a file system. Virtual Replicator does not see storage units with either of these characteristics during pool creation. Storage units with an NTFS file system can be imported into the pool after it has been created (refer to "Importing storage units" later in this module).
- Fault-tolerant storage should be used to ensure maximum pool stability.

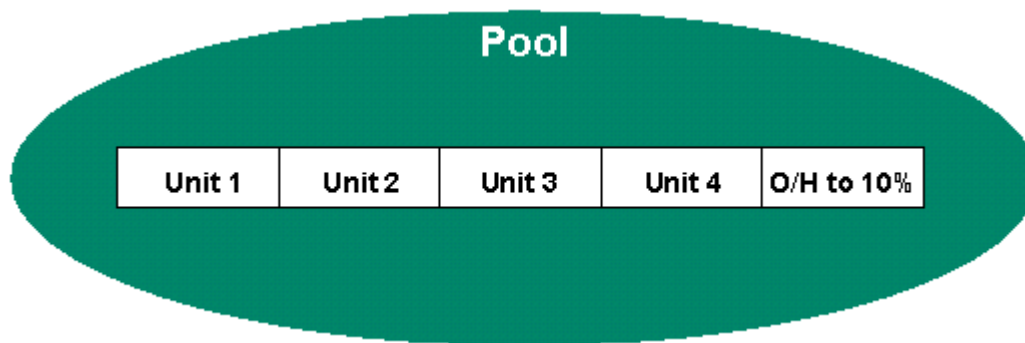
Caution

If one storage unit within the pool fails, you will lose the entire pool. If this happens, you must create a new pool, create new virtual disks, and restore data from appropriate backup media.

- The storage units in a pool should have similar characteristics. For example, use storage units that are all RAID 5 or all RAID 1+0. Mixing different types of storage units in the same pool yields unpredictable results.
- Removable media cannot be used.
- In a clustered environment, only disks residing on the shared storage bus can be used; do not use local disks.
- The Storage Virtual Replicator server should be highly available.

When you create a virtual disk or snapshot in a pool, you cannot specify which storage units to use. Consequently, virtual disks use space from anywhere within the pool.

Only the number of available storage units limits the number of storage pools on a stand-alone computer or cluster.



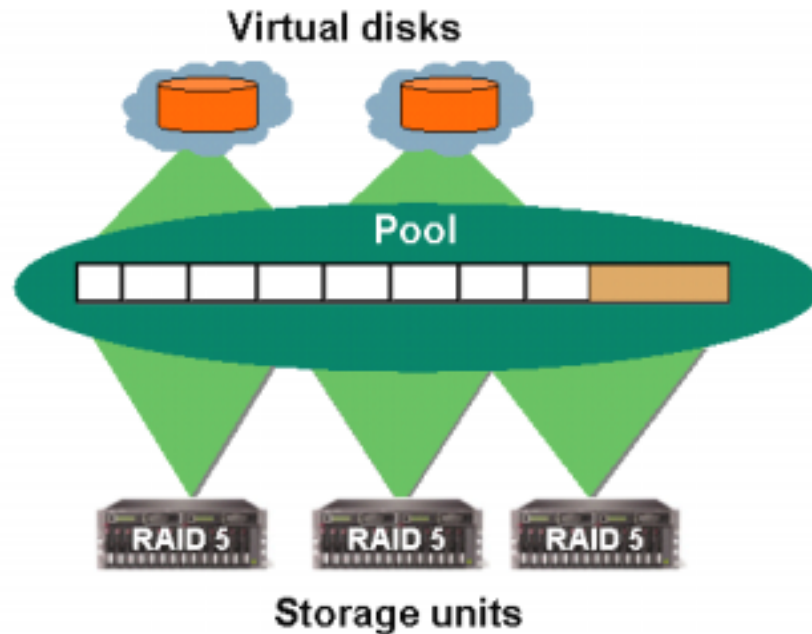
The first step in creating a storage pool is to select the storage units, although more can be added later. The next step is to specify the size of each segment, which determines the maximum virtual disk size. A segment is a fixed-size unit of contiguous blocks. It is the smallest unit of disk space used for allocation of space to virtual disks, and it is the unit of measure for snapshot and copy-out functions. Snapshots and copy-out functions are discussed later in this module.

Note

The capacity of a pool is slightly less than the combined capacities of its storage units because the pool configuration data uses some disk space. The amount of space used by the configuration data varies. It can be up to 10% of the combined capacities of the storage units.

Virtual disks

Virtual disks represent a logical grouping of physical disk space within the storage pool and perform just like physical disks. For example, you can format and map drive letters to them, as well as read and write to them - just like physical disks.



These disks can range in size from 10MB to 2TB, depending on the free pool space and other limits that were set at the time of pool creation.

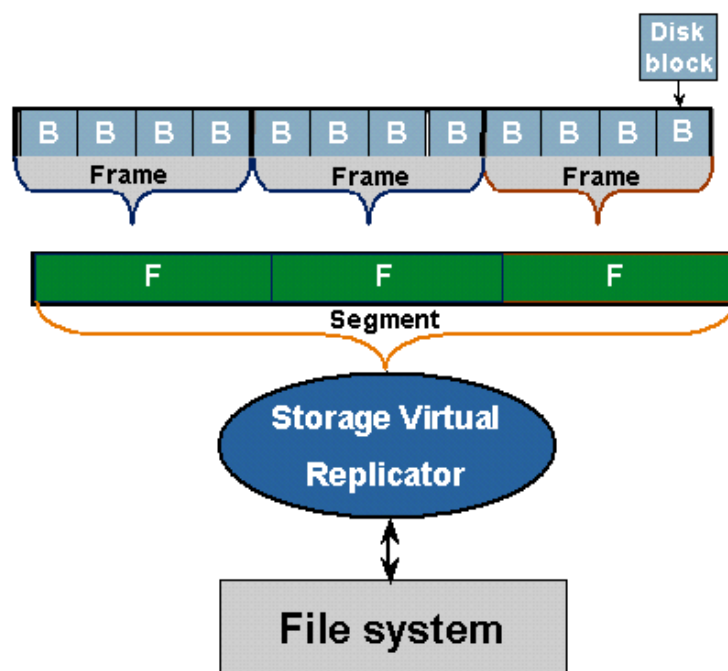
You can use a virtual disk in the same way as a normal disk except:

- A virtual disk cannot be used as a system disk.
- A virtual disk can have only one partition.
- The partition must be formatted with NTFS.
- Disk Administrator cannot be used to create a volumeset, mirrorset, or stripeset on a virtual disk.
- A single pool can have only eight virtual disks.

Note

You can create 2TB virtual disks; however, current firmware and hardware support only four 2TB virtual disks in one pool.

Virtual disk mapping



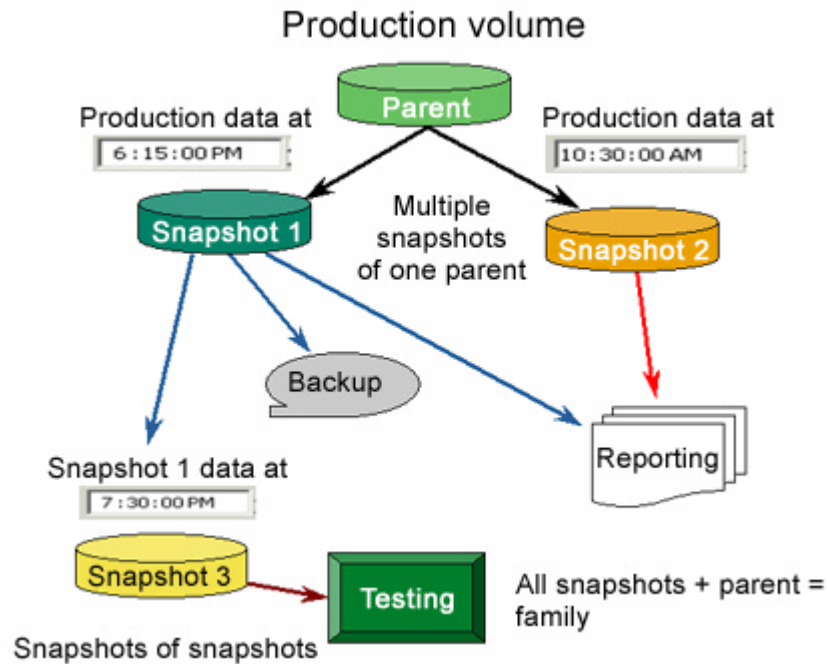
Virtual disks are created by:

- Disk blocks grouped into structures called frames
- Frames grouped together to form segments

A segment is a fixed-size unit of contiguous bytes of disk space and is the smallest unit that the Storage Virtual Replicator software can track. The specified segment size is used to define both the maximum virtual disk size that can be created from the pool and the largest storage unit that can be added to the pool. For example, choosing a segment size of 128KB limits virtual disks and additional storage units in the pool to a maximum of 1TB.

Segment size also determines the smallest unit that would be copied to a snapshot when changes occur on a parent disk. Segment size options range from 32KB to 256KB (128KB is the default). Using a larger segment, the maximum size of the virtual disk increases; but, the amount of pool space that is consumed by snapshots might be greater.

Snapshots



Storage Virtual Replicator enables you to make replicas (called snapshots) of virtual disks in a matter of seconds. Snapshots enable the creation of multipurpose virtual replicas of production data without having to physically copy the data.

A Snapshot is a virtual “point-in-time” copy of another disk that function in exactly the same way as ordinary physical disks. You can read from snapshots and write to them, and you do not have to interrupt your users to create them. You can create snapshots while users are reading from and writing to the original virtual disk.

A snapshot looks like an exact copy of the original virtual disk. It has the same capacity and contains exactly the same data. Making a snapshot is like taking a picture of every byte of data on the original virtual disk at a single instant.

Initially, a snapshot uses almost no disk space from its pool. The snapshot starts to use disk space only when you write data to either the original virtual disk or the snapshot itself.

The original production disk from which a snapshot is created is called the “parent” disk. You can create multiple snapshots from the same parent disk, or you can create snapshots of the snapshots.

The original virtual disk, all its snapshots, and all the snapshots of those snapshots (and so on), are known as a “family.” A family can contain up to 12 snapshots.

Storage Virtual Replicator provides a utility, called SmartSnap, that can automate the number of snapshots maintained for a virtual disk. SmartSnap can be invoked using the command line.

The Storage Virtual Replicator Lifeguard is a system service that monitors storage pools. By default, the Lifeguard checks the capacity of the storage pool once every 60 seconds, reports on pool conditions in the Windows Application Log, and deletes snapshots when pools become nearly full.

Creating snapshots

Creating a snapshot is fast, a matter of seconds, because it does not physically copy the data. The snapshot is pointing to the same data as the parent disk; therefore, there is no need to make a physical copy of the data.

Any data in the cache that has not yet been written to the parent disk is automatically flushed to disk before the snapshot is created.

The name of the snapshot can be up to 23 characters. Choose a name that is different from that of any other pool, virtual disk, or snapshot on the computer or cluster that you are using.

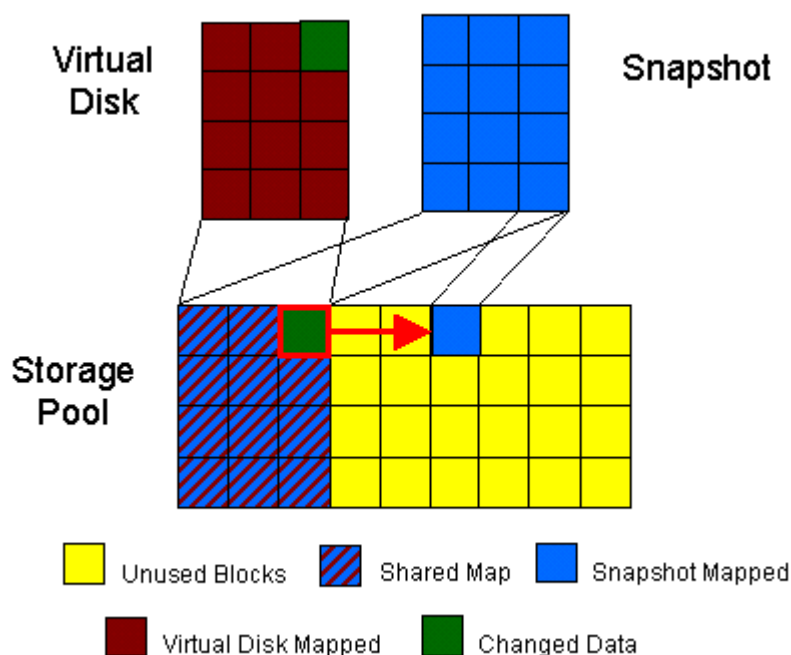
How snapshots work

Initially, the snapshot uses a minimal amount of disk space because it shares the same physical disk space as the parent. When users create, modify, or delete files and directories that are stored on the snapshot or parent disk, the data to be modified must be physically copied to the snapshot data area before it changes. This process is referred to as a copy-out operation.

A snapshot uses disk space only when the parent or snapshot is modified and a copy-out operation is performed. The snapshot consumes disk space in segments. Each copy-out operation consumes a segment of disk space in the pool.

Note

If all data in the parent is modified, the snapshot disk usage will be the same as the parent.



Example

A user creates a file called SMALL.DAT. When a snapshot is first created, a reference to the original file is stored in the snapshot. As shown in the preceding diagram, both the original file and the pointer contained within the snapshot reference the same disk space.

If a user attempts to modify the SMALL.DAT file of the parent, the Storage Virtual Replicator software will perform a copy-out to the disk, automatically making a separate physical copy of the data being changed. Storage Virtual Replicator then updates the parent disk with the new data. At this time, the SMALL.DAT of the snapshot contains the old data and the SMALL.DAT of the parent contains the new data.

When a segment has been copied out, subsequent writes to the segment do not incur copy-out operations. The snapshot has its own copy of the segment, so there is no need to copy it again.

Displaying snapshot information

Use Snapshot Manager to display information about a snapshot. In the left-hand Scope pane of console window, select a virtual disk. The right-hand Results pane shows the following information about each snapshot in the family.

| Column | Description |
|----------|--|
| Name | The name of the snapshot, and in brackets, the drive letter that is mapped to it. |
| Type | Snapshot |
| Capacity | How big the file system and every other piece of software on the system think the snapshot is. For example, the size shown by Windows Explorer. The maximum pool space the snapshot could consume if the entire contents of the snapshot or the parent is modified. |
| Delspace | The amount of space freed in the pool if the snapshot were to be deleted right now. The amount of pool space used exclusively by this snapshot, that is the space of the snapshot not shared with any other snapshots in its family. |
| Created | When the snapshot was created. |
| Family | The family to which the snapshot belongs. |
| Owner | In a cluster, the name of the cluster node that currently owns the pool resource. You do not see this column on a stand-alone computer. |

SmartSnap command

SmartSnap is a utility you can use to create and retain a specified number of snapshots of a single virtual disk.

Typically, when you schedule the creation of a snapshot with Storage Virtual Replicator, the task retains one snapshot for each virtual disk. However, you might want to have a snapshot taken of the same virtual disk every day and keep a week of snapshots.

To create one snapshot at a time up to a specified number, you can run SMARTSNAP.EXE manually from the command line. You can also use the At command or the Windows Scheduled Tasks applet to schedule SMARTSNAP.EXE to create the specified number of snapshots.

After you set the number of snapshots you want to keep of a given virtual disk, SmartSnap examines all the snapshots and determines if there is room for an additional snapshot. SmartSnap will delete one of its own snapshots to make room for a new request, always deleting the oldest one first. SmartSnap will only delete snapshots it has created that are not mapped to drive letters. Errors are logged in the application event log.

If all snapshots are mapped to drive letters, Storage Virtual Replicator creates a single snapshot. This is the only time the number of snapshots that should be maintained is exceeded. If the total number of snapshots for the virtual disk reaches the Storage Virtual Replicator limit of 12, and no periodic snapshots can be deleted, then no further snapshots are taken.

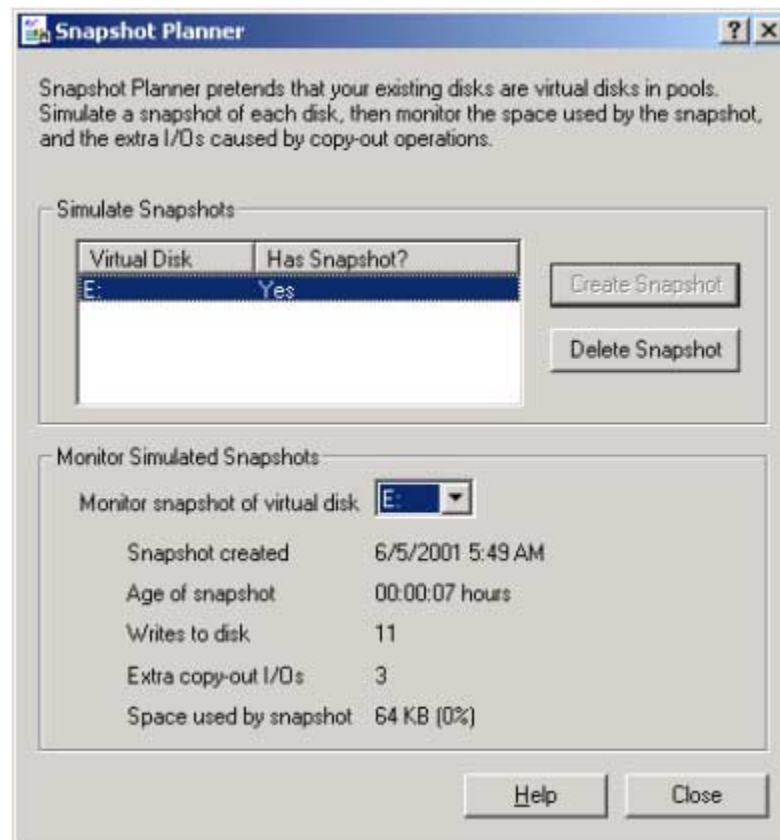
Example

This example shows how to use the Windows Scheduled Tasks applet to schedule SMARTSNAP.EXE for creating a set of seven snapshots of the virtual disk, *myvdisk*.

1. Use the Scheduled Tasks applet to add a scheduled task.
2. Browse to *Program Files → HP → HP OpenView Storage Virtual Replicator → smartsnap.exe*.
3. Set parameters for the task, including the name, time, and frequency.
4. After finishing, open the advanced properties dialog box for the task.
5. Add the SmartSnap command parameters after the end of the path name: *myvdisk /KEEP:7*

The task is listed in the Scheduled Tasks window. When the task runs at the specified time, it will create one snapshot of *myvdisk* each day. Before creating the eighth snapshot, SmartSnap will delete the oldest snapshot and then continue.

Snapshot Planner



Storage Virtual Replicator provides a separately installed tool called Snapshot Planner to help you predict how much space your snapshots will use.

Note

The Snapshot Planner will not allow you to simulate a snapshot of the boot disk (usually C:)

Snapshot Planner tracks actual reads and writes to your existing drives and calculates the amount of space a snapshot of each drive would need and how many additional I/Os the snapshot would cause as a result of copy-out operations.

Snapshot Planner is useful if you plan to migrate all the data on an existing hard disk drive to a virtual disk of the same capacity. It tracks the I/Os to the existing drive and lets you determine how much extra space is needed for the snapshots.

! **Important**

Because Snapshot Planner cannot see virtual disks after they are created, use the Snapshot Planner on the server **before** you set up your pools and virtual disks. After you have created virtual disks in a pool, you cannot use Snapshot Planner to predict the cost of snapshots of your virtual disks.

HP recommends that you use and uninstall Snapshot Planner before installing Storage Virtual Replicator.

Task automation wizards

Storage Virtual Replicator provides the following six wizards for scheduling virtual disk and snapshot tasks:

- **Create snapshot** — The create snapshot wizard schedules the creation of a snapshot of a selected virtual disk at a specified time and frequency. The operation includes deleting any previous snapshot by the same name.
- **Delete snapshot** — The delete snapshot wizard schedules the deletion of a snapshot with a specified name at a predetermined time. If the snapshot name provided does not exist at the time the scheduler runs, no action is taken.
- **Restore from snapshot** — The restore from snapshot wizard schedules the re-creation of a virtual disk from a snapshot. If specified, upon successful completion of the schedule, the previous virtual disk and snapshot are both deleted.
- **Snapshot for backup** — The snapshot for backup wizard schedules a backup operation of a snapshot to tape, including the creation and optional deletion of a snapshot for the backup.
- **Snapshot watchdog** — The snapshot watchdog wizard schedules a job, at a specified frequency, that monitors the resource utilization of a snapshot. The snapshot can be optionally deleted if the resource utilization exceeds the preset values.
- **Workday snapshot** — The workday snapshot wizard schedules the creation of a snapshot of a virtual disk at a defined time (for example, at the start of the work day) and deletion of the snapshot after the defined time (for example, at the end of the work day).

Note

By default, Storage Virtual Replicator performs scheduling tasks by using the built-in Windows Scheduled Tasks applet. To use the scheduling wizards, the Scheduled Tasks service needs to be running and you need to have administrative rights.

Incremental backup support

Some backup utilities use an archive bit to indicate whether a file has been backed up. When a file is backed up, the utility clears or turns off the archive bit indicating that the file does not need to be backed up again during the next incremental backup. If the file changes before the next backup, the bit will be turned on again and the utility will back-up the file during the next incremental backup.

When backing up a snapshot, the backup utility turns off the archive bit of each file on the snapshot. However, the utility does not clear the archive bits of the corresponding files on the parent disk; therefore, they are still on. If a new snapshot is created from the same parent disk, the archive bit of every file on the new snapshot will also be on, even though the files might not have changed between snapshots.

The *on* status indicates to the backup utility that all of the new snapshot files need to be backed up in the next incremental operation, possibly causing duplicate backups. The incremental backup support feature allows normal incremental backups by turning off the archive bits of the files on the virtual disk. The next snapshots that are taken will then have the archive bits correctly set for incremental backups.

To enable incremental backup support, you can specify either of the following:

- A date and time that the incremental backup support operation will use as a reference point, along with a safety margin.

The archive bit will be turned off for files on the parent disk that are older than the specified date and time. The safety margin helps prevent the incorrect turning off of archive bits for files that have not been backed up.

Or

- The name of a snapshot that was backed up. If the snapshot still exists, the archive bit will be turned off for files on the parent disk that correspond to the snapshot files.

You also have the option of creating a log file of incremental backup support operations.

Note

Complete instructions for using the incremental backup support feature are available in the SVR online help.

Managing pools

Storage Virtual Replicator lets you have any number of pools on each stand-alone computer or cluster. The number is limited only by the number of storage units that are available. After you create a pool, Storage Virtual Replicator marks the storage units as offline so that users can no longer access them directly.

Adding storage units in a pool

After you create a pool, you can add storage units to it at any time, even as users access its virtual disks and snapshots. Storage units added to the pool must meet same criteria as that required of units when the pool is created (See “Storage Units” earlier in this module).

Do not add storage capacity to a pool by growing a logical unit using your RAID controller. Storage Virtual Replicator does not support extending a logical drive through the Array Configuration Utility (ACU) and will not recognize the new space. Use the array controller to create a new logical unit and then add it to the pool.

Caution

If you want to add a physical disk to a pool, and the disk has unformatted partitions, delete the partitions before adding the disk to the pool. Failure to do this can result in data corruption.

Importing storage units

Storage Virtual Replicator allows you to import disks with live data directly into a pool with no disruption or downtime. The Import Unit feature enables you to migrate existing physical storage to your virtualized storage environment.

When you import a partitioned storage unit, Storage Virtual Replicator automatically creates a virtual volume for each partition in the unit. The applications that used data on the physical unit can continue to access the data on the virtual disk while the import is in progress. If the physical unit has unused capacity, it will be added to the free space of the pool after the import operation is complete. You can then use this additional capacity for other data storage purposes.

The following restrictions apply when you import a storage unit:

- Before importing a storage unit, ensure that the pool has free space in an amount equal to or greater than 1% (approximately) of the capacity of the storage unit.
- Storage Virtual Replicator does not support the file allocation table (FAT) file system. Therefore, if the storage unit you want to import has FAT partitions, convert them to NTFS before importing the unit.
- In a cluster, the storage unit to be imported must be a shared disk and must also be a cluster resource.

Note

Before you import a partitioned storage unit, HP recommends that you assign drive letters to all of the partitions. This action will help to ensure a successful import. See the Storage Virtual Replicator online help for complete instructions on importing storage units.

Remove storage units from pools

The Remove Unit feature of Storage Virtual Replicator allows you to remove storage units from a pool if the storage is needed for other purposes. However, you can remove units only if no data has been written to them. Because it is not possible to identify which storage units are being used by particular virtual disks, it may be difficult to actually remove units.

Understanding pool free space

The free space in a pool is disk space that is not currently allocated to virtual disks, snapshots, or internal configuration data. Always ensure that pools do not run out of free disk space. If a pool has no free space, further writes to it may fail, and you could lose data. Use Snapshot Planner to help predict disk space requirements **before** you set up your pools and virtual disks.

If the capacity of one of your pools is less than the combined capacities of all of its virtual disks and snapshots, it could become full. When a pool runs out of disk space, you must either add a storage unit to it or delete one of its snapshots or virtual disks.

To manage pools effectively, you should regularly monitor their free space and understand how much space would be freed by deleting virtual disks and snapshots.

Caution

If a pool is full, do not try to free up space by deleting files. Deleting files causes segments of data to be copied out to snapshots, which uses up even more free space in the pool and can cause additional data loss.

Methods for monitoring pool free space

Use any of the following methods to monitor free space:

- Visually monitor pool free space in the snapshot manager MMC window.
- Check the system event log for Storage Virtual Replicator warnings and errors about pool free space.

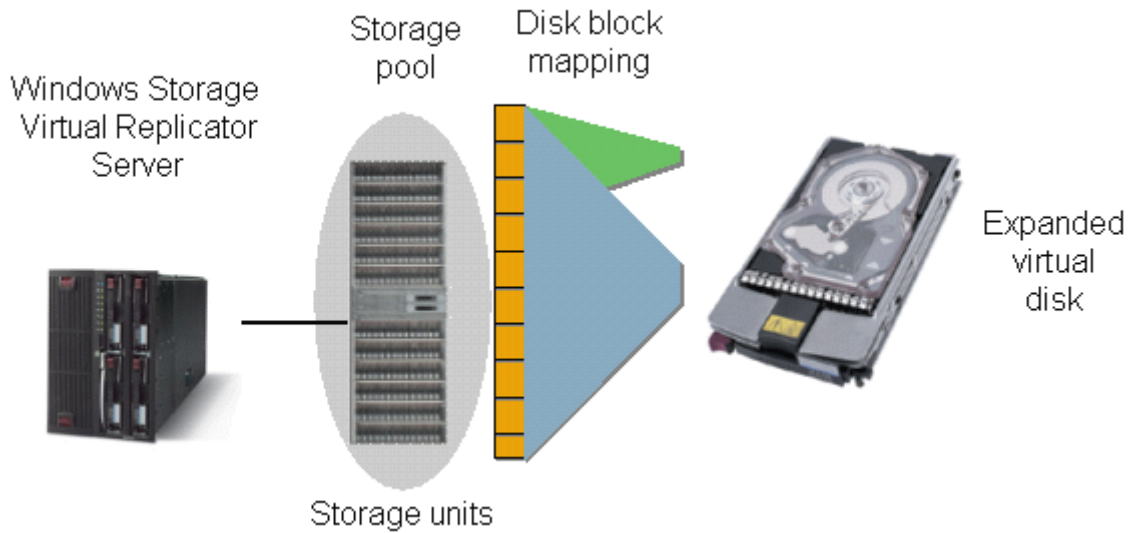
When the free space falls to less than 30 %, Storage Virtual Replicator starts logging warnings every five minutes in the system event log to warn you that the pool is getting full. Then it logs errors every five minutes that say that the free space in the pool is less than five percent. These records have *cpqvrbus* in the source column (on Windows 2000).

- For more control over the pool free space monitoring, use the Storage Virtual Replicator Lifeguard service (Refer to Appendix B of the *Storage Virtual Replicator Systems Administrator's Guide*).

Note

Because it does not recognize a pool, you cannot use Windows Explorer to monitor pool free space. Use only Storage Virtual Replicator tools to monitor pool free space.

Online volume growth



Storage Virtual Replicator offers the ability to increase storage capacity without disrupting operations. Normally, when a RAID set size increases, the operating system does not recognize the size change until you restart the system.

The Storage Virtual Replicator online volume growth feature directs the operating system to update the size of a physical or virtual disk without requiring a restart. Online volume growth instructs the operating system to increase the on-disk partition information for a volume. This allows a volume to grow into unused space made available by either increasing the size of a disk or by deleting one or more adjacent partitions.

When you increase the size of a virtual disk, it consumes more space in the pool. The larger virtual disk reduces the amount of free space that can be used for snapshots. Before performing online volume growth, make sure the pools you have created have adequate free space.

Basic and virtual disks

The online volume growth feature operates only on basic (physical) and virtual disks formatted with NTFS. The following section describes the differences between basic and virtual disks.

Basic disks

A basic disk is a standard partitioned physical disk or a logical disk from a storage array consisting of a partition table and up to four primary partitions.

Configurations of greater than four partitions are possible by creating an extended partition entry (reducing the possible number of primary partitions to three) and creating one or more logical drives. Each primary partition of a logical drive can be formatted with a file system and appears as a volume to the operating system.

Basic disks do not support volume configurations that span different disk controllers. Previously, this functionality was provided by fault-tolerant mechanisms such as software-based striping and mirroring. These configurations are not compatible with online volume growth.

Basic disks are required for Storage Virtual Replicator pool creation and for online volume growth. Windows Dynamic disks **CANNOT** be used for Virtual Replicator pools or online volume growth.

Virtual disks

Storage Virtual Replicator enables the grouping of basic disks into a concatenated pool of disk space. Virtual disks are then created from the storage pool. Each virtual disk contains a single partition formatted with NTFS.

Pools created with Storage Virtual Replicator have always been capable of expansion through the addition of new storage units. With online volume growth, it is possible for virtual disks to expand without rebooting. For example, you can add physical disks to a RAID set, assign those new storage units to an existing pool, and then use the additional capacity to expand any of the virtual disks associated with the pool.

Growing virtual disks

Note

Virtual disks that have associated snapshots cannot be grown using the online volume growth feature. Before growing a virtual disk, you must delete all snapshots of that disk.

Preparing for online volume growth

Performing online volume growth is straightforward. However, perform the following before proceeding to grow your volumes:

1. Make a reliable backup copy. If the disk you plan to grow contains any data, back-up the data before growing the volume.
2. Plan for new storage. Consider the following:
 - a. Adding capacity may increase the time required to create backups.
 - b. Increasing the size of a virtual disk causes it to consume more space in the pool, reducing the amount of free space that can be used for snapshots of virtual disks. Before performing online volume growth, ensure that the pools you have created have adequate free space.
 - c. When replacing hard drives or using the HP Array Configuration Utility to perform array or logical drive expansion, the controller must finish rebuilding, expanding, and extending before using online volume growth.
 - d. Using the ACU to expand an array or extend a logical drive takes approximately 15 minutes per gigabyte. Examine the current controller rebuild and expand priority settings.
3. Verify volume configuration compatibility.
 - a. Windows supports two disk types -- basic and dynamic. The Storage Virtual Replicator online volume growth feature operates only on basic disks formatted with NTFS.
 - b. If the volumes to be used for online growth are currently using FAT or FAT32 file systems, convert them to NTFS using the Windows 2000 CONVERT utility.

**Important**

Dynamic disks, software-based volume sets, mirror sets, and stripe sets with parity are not compatible with online volume growth. Volumes formatted with FAT or FAT32 are not compatible. Only NTFS volumes can be grown.

Before you grow a volume on a basic disk, ensure that space is available immediately adjacent to the end of the partition holding the volume. Only partitions and free space adjacent to the end of a particular volume are eligible to be incorporated into the volume during volume growth. When there is no unused adjacent space for a volume to grow into, it may be possible to make space available, depending on your system configuration.

Virtual disks

A pool must have available free space before you can grow one of its virtual disks. If the pool does not have adequate free space, you must increase the capacity of its pool by adding storage units to it. As explained earlier in the module, you can add storage units to a pool at any time, even when users are accessing its virtual disks and snapshots.

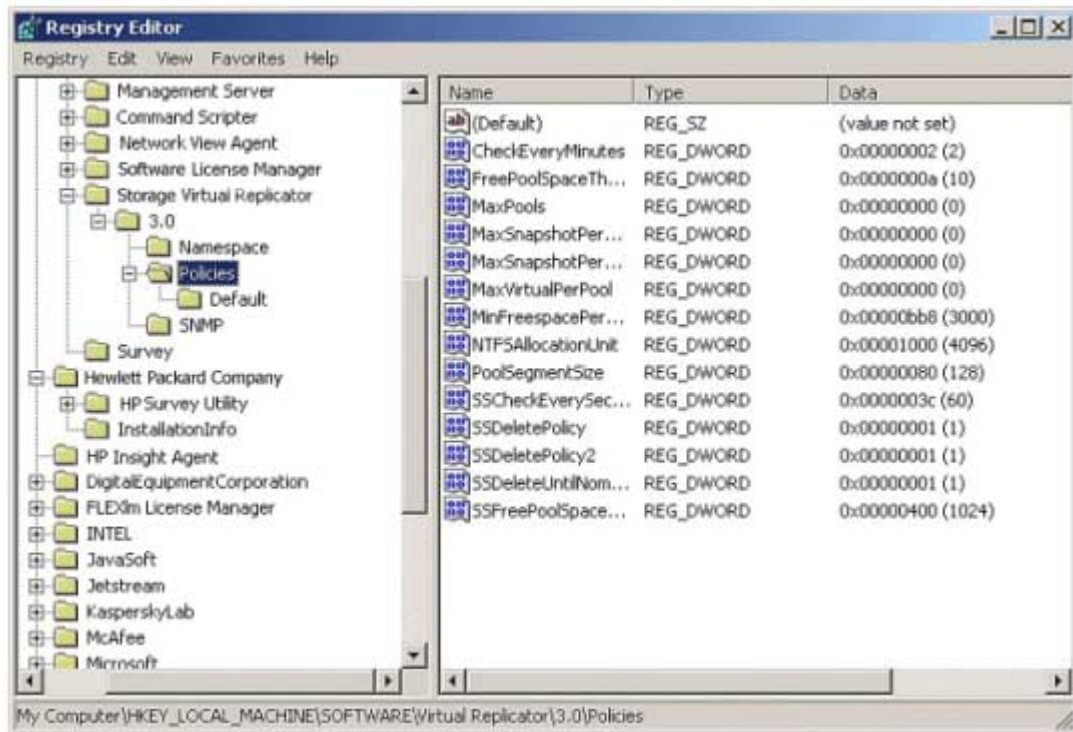
When a storage unit is added to a pool, the size within the pool becomes fixed. Therefore, pool capacity does not increase when you extend a basic disk. The only way to grow a pool is by adding storage units to it.

After you add storage units, you can expand the size of your virtual disks. Online volume growth for virtual disks can be managed from:

- The Microsoft Management Console (MMC)
- The online volume growth wizard on the SVR start menu
- Windows Disk Management function

Storage Virtual Replicator policy management

Policies are system settings that help you manage Storage Virtual Replicator resources. Storage Virtual Replicator policies are stored in the Windows Registry and are preconfigured to follow best practices for Storage Virtual Replicator administration. You can modify these pre-set policies to suit your own environment.



You can set policies for pools, virtual disks, and snapshots. All of the policies can be configured to apply to your entire Storage Virtual Replicator environment. Some of the policies can also be set to apply only to individual pools. For example, if you set a policy that reserves a percentage of the free space of a pool for exclusive use by snapshots, you can have the new setting apply to all pools on your system or only to select pools.

You can use a separate set of policies for the Storage Virtual Replicator Lifeguard service. The Lifeguard policies allow you to monitor storage pools and delete snapshots when pools become full. Lifeguard also monitors pools used for Microsoft Exchange. On cluster systems, policies are maintained separately for each system and not for the cluster as a whole. Therefore, you must set the same policies for each node in a cluster.

To create or change Storage Virtual Replicator policies, edit the Windows Registry key values for Storage Virtual Replicator. The instructions for using the Registry Editor to set policies are available in the Storage Virtual Replicator online help.

Caution

Changing Storage Virtual Replicator policy settings requires editing the Windows Registry, which is advised for experienced users only. If there is an error in the Registry, your computer might not function properly. Be prepared to restore the registry in the event of an error. Refer to the Microsoft Registry Editor Help file for more information.

System-wide policies that apply to all pools are located in the *Policies* subkey. Pre-set default policies are located in the *Policies\Default* subkey. The policies that apply to specific pools are located in the *Policies\Pool\poolname* subkey. For more information on policies refer to the Storage Virtual Replicator online help.

Policies that can be set using the Registry Editor are:

- **CheckEveryMinutes** — Checks Microsoft Exchange storage pools at this interval. Setting this policy to 0 does not disable Lifeguard monitoring
- **FreePoolSpaceThresholdMB** — Checks minimum free space allowed in the pool. The value is expressed in megabytes.
- **MaxPools** — Limits the number of pools that can be created on the system. This value is checked when the user attempts to create a new pool. If the number of existing pools is equal to the policy value, then the creation of a new pool is denied.

- **MaxSnapshotPerFamily** — Limits the number of snapshots that can be created within a family. This value is checked when the user attempts to create a new snapshot. If the number of existing snapshots in the pool is equal to the policy value, then the creation of a new snapshot is denied.

If the value is set to 0, the driver limits the number of snapshots in a family to 12. If this policy is set to 12 or greater, the policy has no effect.

This policy and MaxSnapshotPerPool are checked simultaneously on snapshot creation. If either of these limits is exceeded, the snapshot creation fails.
- **MaxSnapshotPerPool** — Limits the number of snapshots that can be created within a pool. This value is checked when the user attempts to create a new snapshot. If the number of existing snapshots in the virtual disk family is equal to the policy value then the creation of a new snapshot is denied.

If the value is set to 0, the driver limits the number of snapshots in a pool to 96 (12 per virtual disk times 8 virtual disks).

This policy and MaxSnapshotPerFamily are checked simultaneously on snapshot creation. If either of these limits is exceeded, the snapshot creation fails.
- **MaxVirtualPerPool** — Limits the number of virtual disks that can be created within a pool. This value is checked when the user attempts to create a new virtual disk. If the number of existing virtual disks in the pool is equal to the policy value, then the creation of a new virtual disk is denied.

If the value is set to 0, the driver limitation is used. The maximum number of virtual disks per pool is eight; therefore, setting this value to eight or greater has no effect.
- **MinFreespacePerPoolPercent** — Maintains a percentage of the pool for exclusive use by snapshots. This value is checked when the user attempts to create a new virtual disk or grow an existing virtual disk. If the amount of free space in the pool drops below this threshold, the operation is denied.

If the value is set to 0, all of the free space in the pool may be used for new virtual disks or growing existing virtual disks. This policy value is interpreted as a percentage. For example, the DWORD value of 3050 is interpreted as 30.50%.

- **NTFSAllocationUnit** — Used when formatting a virtual disk. This policy is only checked if the user does not specify an NTFS allocation unit size. This policy has the following valid values: 0, 512, 1024, 2048, 4096, 8192, 16384, 32768 and 65536.

If set to 0, the OS default allocation unit is used (4096 bytes).

Note

Since, in most cases, this default provides the highest efficiency for storing data, HP recommends that you not change this value.

- **PoolSegmentSize** — Used when creating a pool. This policy is the default segment size (128 kilobytes) if the user does not specify a segment size. Valid values are: 0, 32, 64, 128 and 256 kilobytes.

If the value is set to 0, pools will be created using the largest allowable segment size.

Note

If a larger segment size is needed to accommodate a large LUN then the larger segment size will be used regardless of this policy setting

- **SSCheckEverySeconds** — Used by the Lifeguard service to determine the number of seconds between checks for free space in the pool.
Setting this policy to 0 does not disable the Lifeguard service. The Lifeguard service must be restarted for changes in this policy setting to take effect.
- **SSDeletePolicy** — Used when free space in a pool drops below the threshold. The snapshot that will be deleted depends upon the value set. Valid values are:
 - 0 -- A snapshot is not deleted and the pool may reach pool full condition
 - 1 -- Oldest snapshot
 - 2 -- Oldest snapshot with a drive letter assigned
 - 3 -- Oldest snapshot with no drive letter assigned
 - 4 -- Newest snapshot
 - 5 -- Newest snapshot with a drive letter assigned
 - 6 -- Newest snapshot with no drive letter assigned
 - 7 -- Snapshot with the largest delspace
 - 8 -- Snapshot with the largest delspace with a drive letter assigned
 - 9 -- Snapshot with the largest delspace with no drive letter assigned

- **SSDeletePolicy2** — Executed only if the primary delete policy (SSDeletePolicy) does not execute. For example, if your primary policy specifies to delete the oldest snapshot with a drive letter assigned, your secondary policy could specify the oldest snapshot without an assigned drive letter. The secondary policy would execute only if the primary policy parameters could not be met.

Setting this policy to 0 means that a snapshot is not deleted and the pool may reach a pool-full condition.

- **SSDeleteUntilNominal** — Used to determine how aggressively Lifeguard deletes snapshots when a pool is out of free space.

A value of 0 results in the deletion of one snapshot every interval (SSCheckEverySeconds) from any pool whose free space is less than the defined threshold amount (SSFreePoolSpaceThresholdMB).

A value of 1 (or any nonzero value) results in the deletion of up to 12 snapshots from any pool whose free space is less than the defined threshold amount.

- **SSFreePoolSpaceThresholdMB** — Deletes snapshots if the free space remaining in a pool drops below this threshold. The snapshot that will be deleted depends on SSDeletePolicy.

Setting this policy to 0 will disable the deletion of snapshots. If the policy has been set for a specific pool, then the specific policy overrides the system-wide policy. The Lifeguard service must be restarted for changes in this policy setting to take effect.

You can set policies by double-clicking any of the entries in the Registry Editor.

Storage Virtual Replicator Lifeguard service

Storage Virtual Replicator Lifeguard is a utility that:

- Monitors storage pools and removes snapshots when a pool is nearly full.
- Monitors the storage pools used by Microsoft Exchange. On Exchange 5.5, Lifeguard shuts down Exchange if the disks used are in pools that are nearly full.



Important

Automatic shutdown of Exchange is not supported on Microsoft Exchange 2000.

Monitoring pool free space using the Lifeguard service

The Storage Virtual Replicator Lifeguard service is installed and started automatically. The service checks each drive letter on a system to see if it is a virtual disk or snapshot. If it is either a virtual disk or snapshot, Lifeguard checks the storage pool of the disk for its amount of current free space. This check is performed once every 60 seconds.

By default, when the free space in a pool drops below 1024MB, Lifeguard begins deleting multiple snapshots, beginning with the oldest, until free space reaches 1024MB. If for any reason this policy is not carried out, a secondary policy takes effect so that Lifeguard deletes snapshots with the largest delspace to free up space in the pool.

You can change these default policies by modifying the Windows Registry. Storage Virtual Replicator Lifeguard posts events in the Application Event log, which you can view using the Event Viewer. An event will be entered for each disk that exceeds the threshold, and additional events will be entered when a snapshot is deleted.

Monitoring pool free space in a Microsoft Exchange environment

If you install Microsoft Exchange on a virtual disk, the Storage Virtual Replicator Lifeguard service monitors the free space in the storage pool that contains the virtual disk. Lifeguard determines which disks are being used to store Exchange data. Each disk is then checked to see if it is a virtual disk. If it is a virtual disk, Lifeguard checks the amount of current free space in the storage pool that the disk is from. If the amount of free space is less than a specific threshold, Lifeguard gracefully shuts down Microsoft Exchange 5.5.

By default, Storage Virtual Replicator Lifeguard shuts down Microsoft Exchange when the storage pool has only 10MB of space left. This check is made once every two minutes and has very little performance impact on your system. You can change these defaults by creating or modifying settings in the system registry.

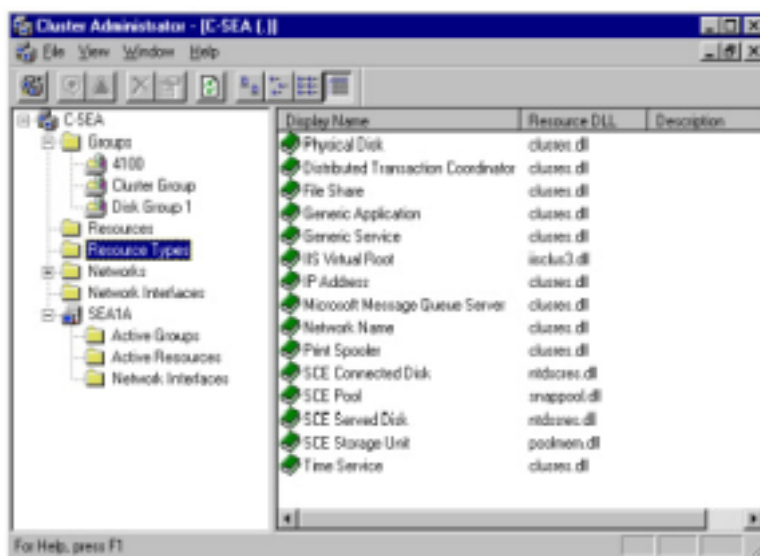
Virtual Replicator Lifeguard posts events in the Application Event log, which you can view using the Event Viewer. An event is entered for each disk that exceeds the threshold, and additional events are entered when the shutdown of Microsoft Exchange has started and completed.

Cluster support

Storage Virtual Replicator runs on top of Microsoft Cluster Server (MSCS) when cluster support is required to provide higher availability for data and applications. In an MSCS cluster, failover and failback of pools, virtual disks, and snapshots are performed as a unit.

Note

Storage Virtual Replicator must be installed after installing MSCS. During the Storage Virtual Replicator installation, necessary cluster resources are installed only if MSCS is detected. For proper failover operation, Storage Virtual Replicator must be installed on all nodes of the cluster.



When using Storage Virtual Replicator on an MSCS system:

- When you create pools in a cluster, Storage Virtual Replicator automatically creates all necessary groups and resources. It also sets up correct dependencies, possible owners, and default properties so that your pools can fail over within the cluster.

- For each pool, Storage Virtual Replicator creates a cluster group named *poolname* group (where *poolname* is the name you gave the pool). It also creates a resource for the pool itself. This resource has the same name as the pool and is of type SCE pool.
- Do not use Cluster Administrator to set up or rename any of the cluster resources. If you do this, you may not be able to access your data.
- There are no cluster resources for virtual disks or snapshots. The virtual disks and snapshots in a pool automatically display on whichever node currently owns the pool resource.
- It is recommended that you have a backup copy of the Cluster Registry in the event you need to perform a system recovery.

For example: You create a pool in a cluster and name it RAID pool. Storage Virtual Replicator creates a new cluster group for the pool called RAID pool Group. This group contains the pool resource, which is also called RAID pool.

By default, all nodes in the cluster are “Possible owners” of the pool resource. After setting up the pool, if you find it necessary to restrict which nodes own the pool resource, you can use Cluster Administrator (see the Microsoft Cluster Administrator documentation for instructions).

After failover, Storage Virtual Replicator cluster groups do not automatically fail back. If you want a group to have failback capabilities, you must use Cluster Administrator to manually configure the group.

**Important**

In a cluster, snapshot manager **must** be used to create pools. Snapshot manager automatically creates cluster resources. Do **not** use Microsoft Cluster Administrator to rename the pool resource because you may not be able to access your data.

SNMP support

Storage Virtual Replicator supports Simple Network Management Protocol (SNMP) for the exchange of management information between management console applications and managed entities.

When you install Storage Virtual Replicator, you also install:

- **SNMP agent** — A processing element that retrieves local management information based on requests from applications that are monitoring the nodes.
- **Management Information Base (MIB)** — A collection or database of managed objects that defines the variables in tables, data to be retrieved, and presentation format for the data.

The SNMP agent implements the return of data to whichever node requested it. The MIB is installed when you install Storage Virtual Replicator on the local machine. The default location is:

\Program files\HP\HP OpenView Storage Virtual Replicator.mib*

Note

For more information on using the SNMP management application, refer to SNMP documentation.

User interface options

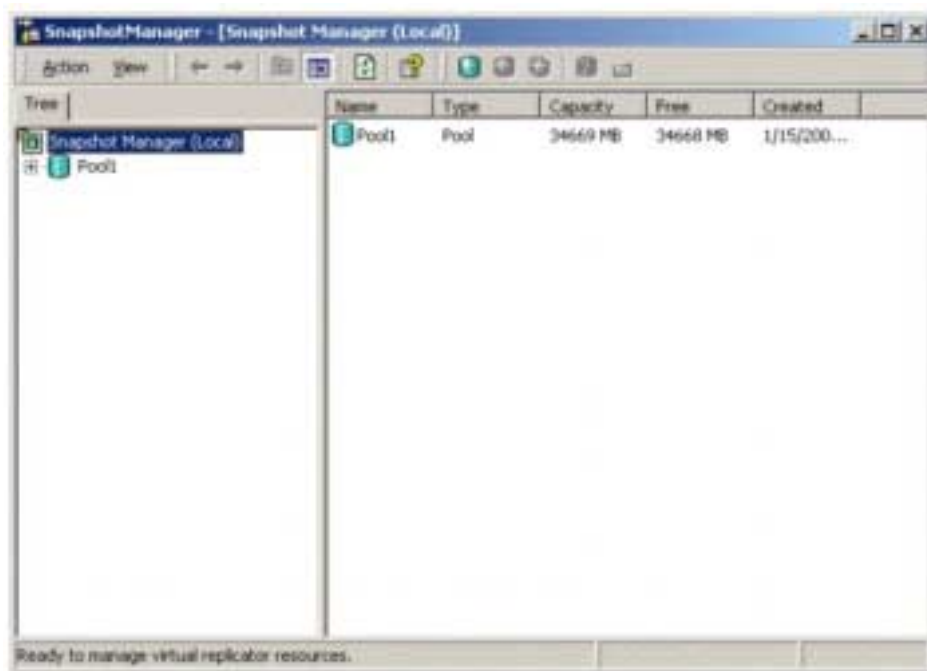
Storage Virtual Replicator offers the following choices for interacting with the software:

- Microsoft Management Console (MMC) interface
- Command line interface (CLI)

Each of these interfaces allows you to fully monitor and manage your storage resources.

Microsoft Management Console interface

MMC is Microsofts management environment. It allows you to use different management tools to manage local and remote computers from within the same window on your desktop.



Management tools that are run in the MMC environment are called snap-ins. Storage Virtual Replicator provides the snapshot manager snap-in, which enables management of pools and their virtual disks.

Command line interface

Storage Virtual Replicator provides a command line interface (SnapMgr) to automate tasks using commands for batch jobs. For example, you might create a batch job to automate your data back-up process.

The following table describes each command set.

| SnapMgr command | Description |
|------------------------|---|
| DRIVES | Displays available drive letters to map to virtual disks and snapshots |
| MANAGE | Controls which computer or cluster you manage (only available at the SnapMgr prompt) |
| POOL | Manages pools |
| SNAPSHOT | Manages snapshots |
| UNITS | Displays storage units you can use to create a new pool or to add to an existing pool |
| UTILITY | Enables support for incremental backups of virtual disks |
| VIRTUALDISK | Manages virtual disks |

Note

These commands are discussed in more detail in the Storage Virtual Replicator System Administrator's Guide at: <http://www.hp.com> -> Storage -> Storage Software -> Technical Documentation

As with MMC snap-ins, you can use the SnapMgr command line commands to manage both local and remote computers and clusters.

Support for Windows tools

Storage Virtual Replicator integrates with the following Windows tools and features:

- Performance Monitor
- Mounted volumes
- Disk Defragmenter

Performance Monitor support

Storage Virtual Replicator supports Windows Performance Monitor, which displays the statistics of virtual disks and snapshots using logical disk performance counters such as disk read bytes/s and disk write bytes/s. Performance counters for virtual disks and snapshots are listed under the PhysicalDisk or LogicalDisk performance object.

In addition, Storage Virtual Replicator adds its own objects to the list of objects that can be monitored. These additional objects are:

- SVR_Pool
- SVR_VirtualDisk
- SVR_Snapshot

Using the special counters listed under these objects, you can monitor performance activity specific to Storage Virtual Replicator, for example, available free space in a pool or the delspace of a snapshot.

Mounted volume support

Virtual disks created with Storage Virtual Replicator can be used as Windows volume mount points. The Windows Disk Management tool allows you to set up directories on a volume as mount points for other volumes. Users and applications can refer to a mounted volume by its mount path, rather than by a drive letter. Mount points give you access to more drives because you are not restricted to the 26-drive letter limit.

The mount point feature can be effectively used for managing virtual disks and snapshots. For example, you can assign a virtual disk as a mount point and mount the snapshots to the virtual disk. The snapshots do not use up drive letters and are easy to manage.

However, remember that several Storage Virtual Replicator features such as incremental backup support, online volume growth, and virtual disk formatting require virtual disks to have a mapped drive letter.

Disk Defragmenter support

Storage Virtual Replicator is fully integrated with the Windows Disk Defragmenter tool. You can defragment virtual disks to increase I/O performance in much the same way as you would defragment a physical disk. The Disk Defragmenter operation finds and consolidates fragmented files and folders on the volume.

Disk Defragmenter also consolidates your free space, making it less likely that new files will be fragmented. As a result, your system gains access to your files and folders and saves new ones more efficiently.

If you defragment a virtual disk that has a snapshot, the process of moving the data causes copy-out operations. Although the data is not changing, the contents of sectors on the disk are changing because the data is being moved to new locations on the disk. This movement causes copy-out operations that degrade performance and waste disk space. To avoid unnecessary copy-out operations, delete all the snapshots on a virtual disk before defragmenting.



Important

Because of a Windows restriction, you cannot defragment a virtual disk that has an allocation unit size greater than 4KB. Accordingly, Storage Virtual Replicator uses 4KB as a default allocation unit size.

Interaction with other Windows tools

This section includes best practices and restrictions for using Storage Virtual Replicator with other Windows tools, such as Disk Management and Cluster Administrator.

- Whenever there are two ways to do a task -- using Storage Virtual Replicator or using a Windows tool -- always use Storage Virtual Replicator.

Example

- Use Storage Virtual Replicator to delete a pool in a cluster, not Cluster Administrator.
- Use Storage Virtual Replicator to map drive letters to virtual disks and snapshots, not Disk Management.
- Do not use Windows explorer to monitor free space in a pool; Windows Explorer does not recognize pools.
- Do not use Storage Virtual Replicator at the same time as Windows Disk Management or Logical Disk Manager. Doing so can result in unpredictable behavior.
- Close Logical Disk Manager whenever you are using Storage Virtual Replicator management tools.
- Do not perform disk management tasks, such as mapping drive letters or formatting disks, on disks that are part of a Storage Virtual Replicator pool.
- Do not perform online volume growth of basic or virtual disks at the same time as other major disk management operations, such as defragmenting and disk checking.
- As an extra precaution, before performing any tasks with disk management, scan for hardware changes in order to update disk information.

Note

The task descriptions in the Storage Virtual Replicator online help may contain more instructions for using other Windows tools for specific tasks.

Installation prerequisites

Refer to the SVR website for the latest installation information. Go to hp.com and select Storage, Software, Storage Virtual Replicator then Technical Documentation.

Software

- Microsoft Windows operating system
- Microsoft Internet Explorer 5.01 or greater

Hardware

- An Intel-architecture, 32 bit processor
- Minimum 128MB of memory (256MB recommended)
- 100MB of disk space for a full installation

Licensing

Before you can use the Storage Virtual Replicator software on one or more systems, you must have a valid license. To acquire the license, follow the instructions on the license key retrieval instruction sheet included with the Storage Virtual Replicator product.

As explained in the instruction sheet, you obtain a license key by going to the HP website and providing the Authorization ID printed on the sheet. Within 48 hours (normally sooner), you will receive an email from HP that contains the information you need to properly set up licensing and operate Storage Virtual Replicator.

Set up and manage Storage Virtual Replicator licensing by using the Storage License Manager (SLM). This tool is installed during the installation of Storage Virtual Replicator. SLM controls the number of Storage Virtual Replicator licenses, which ensures that all systems are licensed and helps users comply with the license agreement.

SLM allows software licenses to be available (or float) on the network instead of being tied to a particular machine. Users can more efficiently use fewer licenses by sharing them on the network. As the administrator, you can control who uses the licenses and on what machine (or node) the licenses are available.

Note

If Storage License Manager is already running on another node—for example the Management Appliance—you can use that SLM service rather than running the service locally.

After a server requests a license, it is provided to that server and cannot be used for another server while that license is in use.

After you receive the license key, use SLM to create a license file. The license file allows SLM to implement the license properly.

If necessary, you can re-execute SLM to add, change, or delete license files. For more information about SLM tasks and features, see the Storage License Manager online help.

Installation

- Log on with administrator privileges.
- Run executable if necessary.
- Select *Storage Virtual Replicator*.
 - If desired, may select *Snapshot Planner*
 - Snapshot Planner must be installed prior to SVR
- Follow the setup wizard.
 - Choose installation type:
 - ◆ Complete
 - ◆ Custom
 - ◆ Management
- Restart your computer when instructed to do so.

Learning check

1. Briefly explain the purpose of Storage Virtual Replicator.
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.....
.....
.....
2. List three of the benefits of Storage Virtual Replicator.
.....
.....
.....
.....
3. What is the maximum size of a storage pool? What is the maximum size of a virtual disk? What is the maximum number of virtual disks in a storage pool?
.....
.....
.....
4. What is a snapshot? How long does it take to create one?
.....
.....
.....
.....
5. List and describe the function of three of the task automation wizards for snapshots.
.....
.....
.....
.....

6. Describe how Storage Virtual Replicator manages online volume growth. What types of disks are supported?

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7. What additional functionality is offered by Storage Virtual Replicator to support Microsoft cluster server installations?

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8. What are the two choices for interacting with Storage Virtual Replicator?

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9. When used with Storage Virtual Replicator, which units can Secure Path manage?

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10. List the installation prerequisites for Storage Virtual Replicator?

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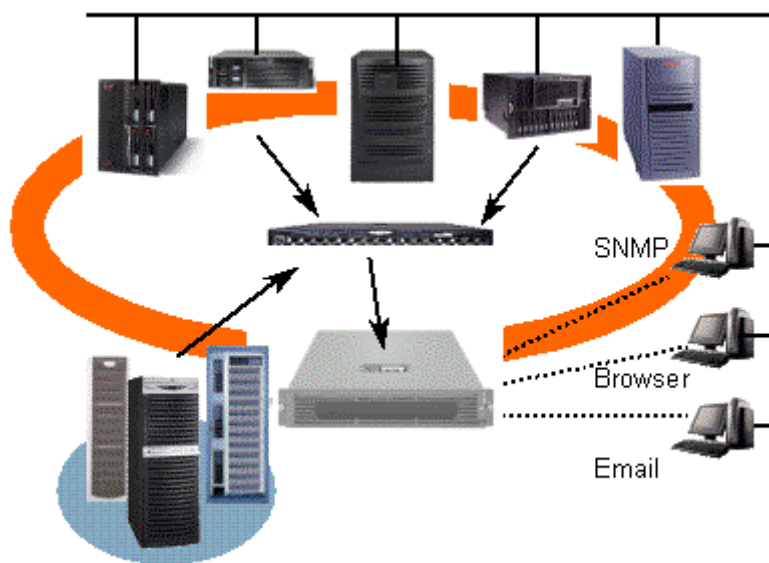
.....

Objectives

After completing this module, you should be able to:

- Identify the software components that provide the Storage Management Appliance basic functionality.
- Identify the software components that provide the Storage Management Appliance (SMA) added functionality.
- Identify the default passwords for the Web agent, the operating system and the RILOE board on the Storage Management Appliance.
- Identify security features that can be used with the Storage Management Appliance.
- Identify and describe the purpose, features and functions of the links from the primary navigation bar.
- Describe the methods to install software.
- Explain discovery types used to find all devices in your SAN.
- Identify the function Automation Manager provides to manage your storage operations.

Overview



Enterprise storage site configuration

The Storage Management Appliance benefits your enterprise in several ways:

- Increases uptime and enables faster repair times by using a modular approach to storage area network (SAN) troubleshooting.
- Aids troubleshooting by creating a consistent interface between the SAN and the monitoring entities.
- Lowers your cost of ownership by identifying specific repair actions and greatly reducing unscheduled outages.
- Enables efficient centralized management of large heterogeneous SANs

You can achieve these benefits without affecting your enterprise because the appliance offloads the monitoring and failure analysis from the SAN, reducing the processor load of your production hosts (such as backup and application servers).

The Storage Management Appliance and its software provide a centralized point for managing and monitoring SAN elements -- including switches and storage devices -- to simplify management tasks and reduce management costs.

The Storage Management Appliance is a hardware device that connects directly to the SAN fabric or storage network layer and performs management functions without using a host computer. This host-independent approach preserves valuable application processing cycles while accommodating different computing platforms in an open SAN environment.

Features

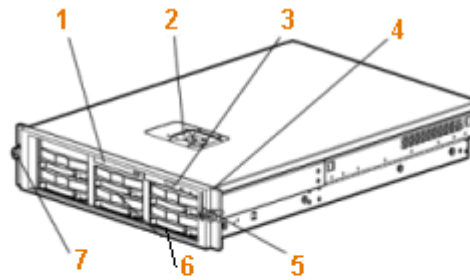
The Storage Management Appliance is designed to provide maximum uptime to the enterprise environment. Because error messages often precede equipment failures, the Storage Management Appliance simplifies the analysis of these error messages using an easily accessible web-based log.

Features of the Storage Management Appliance include:

- **FRU identification** — The Storage Management Appliance provides field replaceable unit (FRU)-level identification for the storage controllers and SAN fabric switches. The appliance communicates with monitored controllers in-band over the SAN and analyzes the information received to provide FRU-level identification of failed or degraded components. Typically, monitored switches are managed out-of-band over the LAN; however, you can forward all switch management data in-band (over the SAN) and route it back through one switch that is connected to the LAN. You can enter the physical location of each monitored entity, simplifying the replacement of failed components.
- **FRU notification** — The Storage Management Appliance is the outgoing point of access to local and remote monitoring entities. The appliance can be configured to forward SNMP traps to:
 - Selected users or groups
 - HP Insight Manager
 - Third-party management applications such as Tivoli Enterprise, Computer Associates Unicenter TNG, or Tivoli NetView (AIX)

Site notification can occur through the Internet to email, web browsers, or pagers.

Hardware components



- 1 1.44 MB (3.5 inch) floppy disk drive
- 2 Latching mechanism (facilitates easy hood removal)
- 3 24x Max CD-ROM (with easy front ejection removal)
- 4 Front LED's (show server status)
- 5 Unit identification button and LED
(for easy in rack server identification)
- 6 Two 1 inch wide Ultra3 SCSI 18.2GB
Hot plug hard drives
- 7 2U form factor

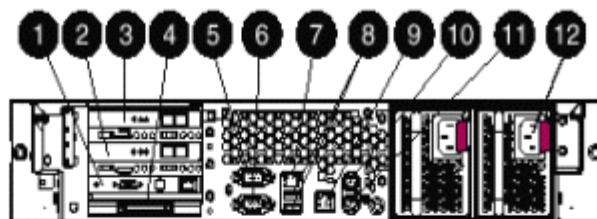
The Storage Management Appliance also includes:

- Intel Pentium III 1.26 GHz Processor
- 1GB memory
- Two Fibre Channel adapters
- Two 10/100 Base-T network adapters
- Remote Insight Lights-Out Edition (RILOE) board

The Storage Management Appliance was designed to be a “headless” unit that is accessed by a web browser. If required, a monitor can be attached to check the unit status. The RILOE board provides service personnel with health monitoring and troubleshooting functionality if needed. Notification is accomplished using SNMP traps.

Note

The appliance resides on a Fibre Channel Switched Fabric. Use on an Arbitrated Loop is not supported.



- | | |
|---|-------------------------------|
| ❶ Remote Insight Lights-Out Edition board | ❷ RJ-45 connector for NIC 2 |
| ❸ PCI Fibre host bus adapter | ❸ USB connectors (black) |
| ❹ PCI Fibre host bus adapter | ❹ RJ-45 connector for NIC 1 |
| ❺ VHDCI FC connector (SCSI port 1) | ❺ Mouse connector (green) |
| ❻ Serial connector (teal) | ❻ Keyboard connector (purple) |
| ❼ Video connector (blue) | ❼ Power connector |

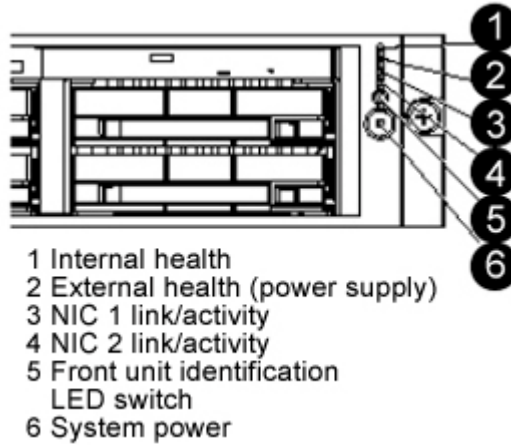
Hardware installation

The appliance hardware installation is a straightforward procedure. For detailed instructions on installing the appliance, refer to the documentation that ships with the appliance.

A brief summary of the steps to install your Storage Management Appliance follows:

1. Select an appropriate site for your rack.
2. Attach rack-mounting hardware to the rack and to the Storage Management Appliance.
3. Mount the Storage Management Appliance in the rack.
4. Attach the cable management arm to the rack.
5. Connect the network and power cables.
6. Start the Storage Management Appliance and allow the default configuration.

Front panel LEDs



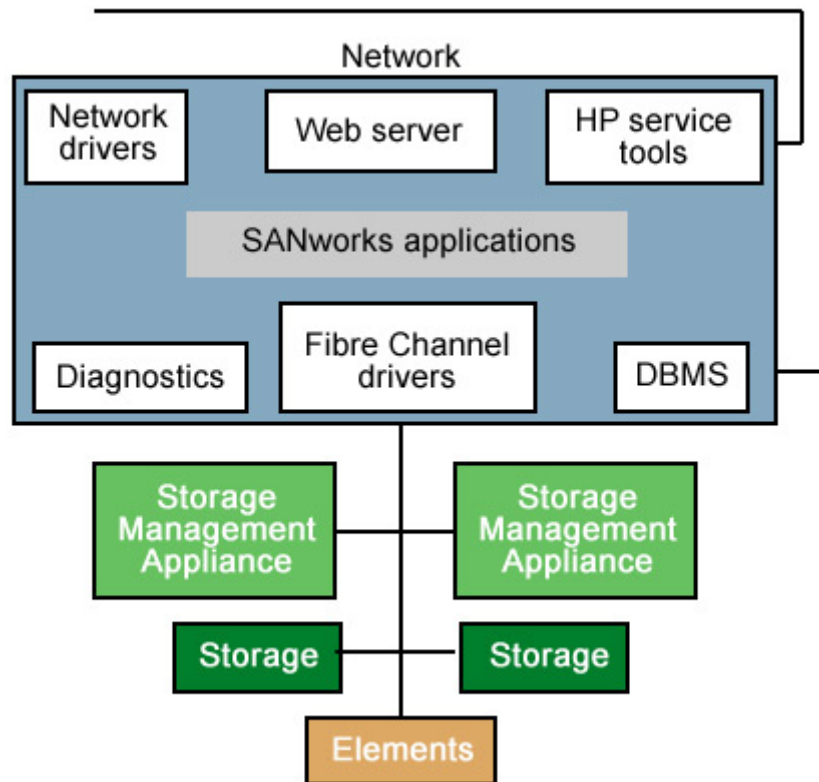
After initial system power up, locate the LED indicators on the front panel. These LEDs indicate:

- **Internal health**
 - ♦ Green – Normal
 - ♦ Amber – System degraded
 - ♦ Red – System critical
- **External health**
 - ♦ Green – Normal
 - ♦ Amber – Power redundancy failure
 - ♦ Red – Critical power supply failure
- **NIC 1 and 2 link/activity**
 - ♦ Green – Network link
 - ♦ Flashing – Network activity
 - ♦ Off – No link or activity
- **Front unit identification LED switch**
 - ♦ Blue – Activated
 - ♦ Off – Deactivated
- **System power**
 - ♦ Green – System on
 - ♦ Amber – System off but power still applied
 - ♦ Off – System has no power

Note

There are similar LEDs on the back of the Storage Management Appliance.

Software components



The Storage Management Appliance is based on an embedded operating system. The initial preparation the appliance is done at the factory and includes:

- Device driver installation
- System configuration
- Performance tuning
- Operating system environment preparation

To minimize configuration issues, the appliance uses a Database Management System (DBMS) to store and manage data locally and to generate notifications. Installation procedures are covered later in this module.

After installing the Storage Management Appliance, the user launches the Storage Management Appliance Software, which is the central interface to all of the software components installed on the Storage Management Appliance. In addition, the Storage Management Appliance Software provides the installation services for other supported software.

Note

Only run software that is supported on the Storage Management Appliance.

Storage Management Appliance operating system

The operating system for the appliance is a specifically configured version of Windows 2000 Server called the SAN Application and Management operating system. The operating system allows the hardware to communicate with the Fibre Channel storage network and with the Ethernet network. It supports the collection of data and provides a means for the data to be accessed by the user and by the storage software applications that reside on the appliance.

The Storage Management Appliance operating system supports the following:

- Peripheral support [NICs and host bus adapters (HBAs)]
- Microsoft Data Engine (MSDE) (SQL version)
- Fibre Channel drivers
- RILOE board
- Elm server (Web server)

**Caution**

At no time should the Windows 2000 Server operating system be reloaded without using the appliance recovery CD. This will cause the appliance to stop functioning.

Storage Management Appliance Software



The Storage Management Appliance Software provides a central, host-independent, unobtrusive way to manage and monitor your storage elements. These elements include devices such as switches, hubs, and RAID arrays and the management applications that control them. You can use the Storage Management Appliance as a single point of management for all SAN applications and devices.

Because the Storage Management Appliance is located outside the data path, it performs management functions without involving host computers. Data transfers proceed independently between computers and storage devices. The Storage Management Appliance provides the following SAN-wide functions:

- Monitors storage elements for failure, warning, and informational events.
- Manages elements and accounting services for storage devices.

The core services of the updated Storage Management Appliance Software include:

- **Security** — Provides network security features for domain and workgroup memberships as well as Storage Management Appliance user groups.
- **Application Installer** — Installs and removes optional HP storage management applications with an installation wizard.
- **Command View EVA** — Launches the element manager for controlling your HSV-based storage systems.
- **HSG Element Manager** — Launches the element manager for controlling your HSG-based storage systems.
- **Licensing** — Allows you to control the installed applications that make use of the Globetrotter FLEXlm licensed manager software.
- **Management Agents**—Provides tools for managing the hardware devices of your Storage Management Appliance.

- **Automation**—Automates the management of your SAN through the use of policies.
- **Remote Access**—Provides logon information required for communication between network management applications.
- **Event/Notification**—Sets up notification settings for specific events so your users are kept aware of important activity in the SAN.
- **Discovery**—Manages the storage elements of which the Storage Management Appliance is aware; set by IP address ranges.
- **Auditing**—Logs activities on the Storage Management Appliance, so you can see which users performed which activities.
- **Backup/Restore**—Backs up data specific to your Storage Management Appliance (database and application files).
- **Debug/Trace**—Makes entries in the Debug and Trace logs. This feature is available for HP support personnel.

In addition to these core services, you may purchase optional HP storage management applications. If you have HP storage management applications installed, you can access them through the *Tools* page of the Storage Management Appliance Software.

Additional functionality can be added to the appliance by installing add-on products such as Business Copy, Continuous Access EVA, Data Protector, OpenView SAM, Secure Path Manager, Storage Provisioner and anti-virus and backup software.

Browsing to the appliance

The Storage Management Appliance is preconfigured at the manufacturing site to simplify access. The appliance is configured by default to use Dynamic Host Configuration Protocol (DHCP) and Domain Name Service (DNS).



Important

Ensure that both DHCP and DNS are functional on the LAN before attempting to install the Storage Management Appliance. If these services are not available, then the networking parameters will have to be reconfigured for static IP addressing.

When first powered up, the unit connects to the network automatically. Access the unit through your web browser. The system name of the appliance is:

- **For the second-generation appliance** — “SMAxxxxxxxxxx,” where “xxxxxxxxxx” is the serial number (SN) of the appliance.
- **For the first-generation appliance** — “SWMAxxxxxx,” where “xxxxxx” is the last six characters of the serial number of the appliance.



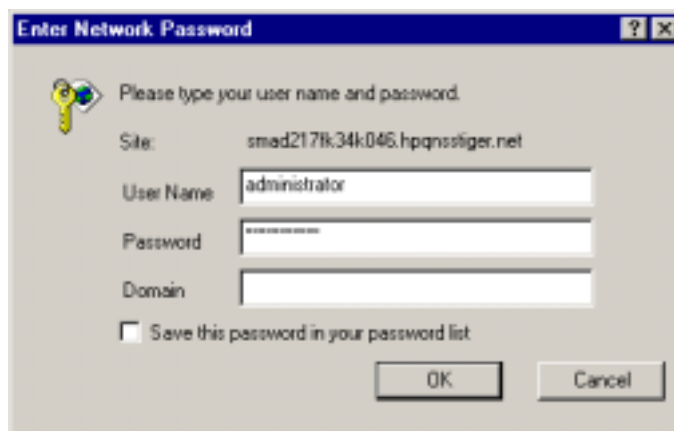
Note

To ensure that you are not accessing cached data when you browse to the appliance, you should change your Internet browser settings to check for a newer version of the page each time it is visited (Select *Tools* → *Internet Options* → *(Temporary Internet Files) Settings*).

Passwords

The Storage Management Appliance user names and passwords determine the level of access to the appliance. After clicking in the *storage management appliance* box, the web agent login screen appears.

After successful login to the web agent, the Storage Management Appliance operating system login box appears.



Note

Do not confuse the operating system user name and password with the browser prompted user name and password. The initial browser login is used for authentication by the web agents but does not provide access to the operating system.

The RILOE board user name and password are used if logging in through the RILOE board instead of using a browser.

The following table lists the default user names and passwords.

| Area | User name | Password |
|----------------------------|-----------------------------|---|
| Web agent—Initial log on | Administrator/administrator | Administrator/administrator |
| Appliance—Operating System | Administrator/administrator | adminxxxXxx admin followed by the last six digits of the serial number reversed; for example, if the last six digits of the appliance serial number are 31K001 then 100K13 would be typed after admin. The alphabetic character must be upper case. |
| RILOE board | Administrator | From the tag attached to the appliance |

Note

User names and passwords are case sensitive

Security

The Storage Management Appliance Software is capable of securely allowing users with various privilege levels to work with your storage devices and applications. The security feature allows you to set up users with different privilege levels and optionally use Secure Sockets Layer (SSL) to encrypt the sending of sensitive information, such as password information. The system maintains audit information that allows an administrator to review user activities.

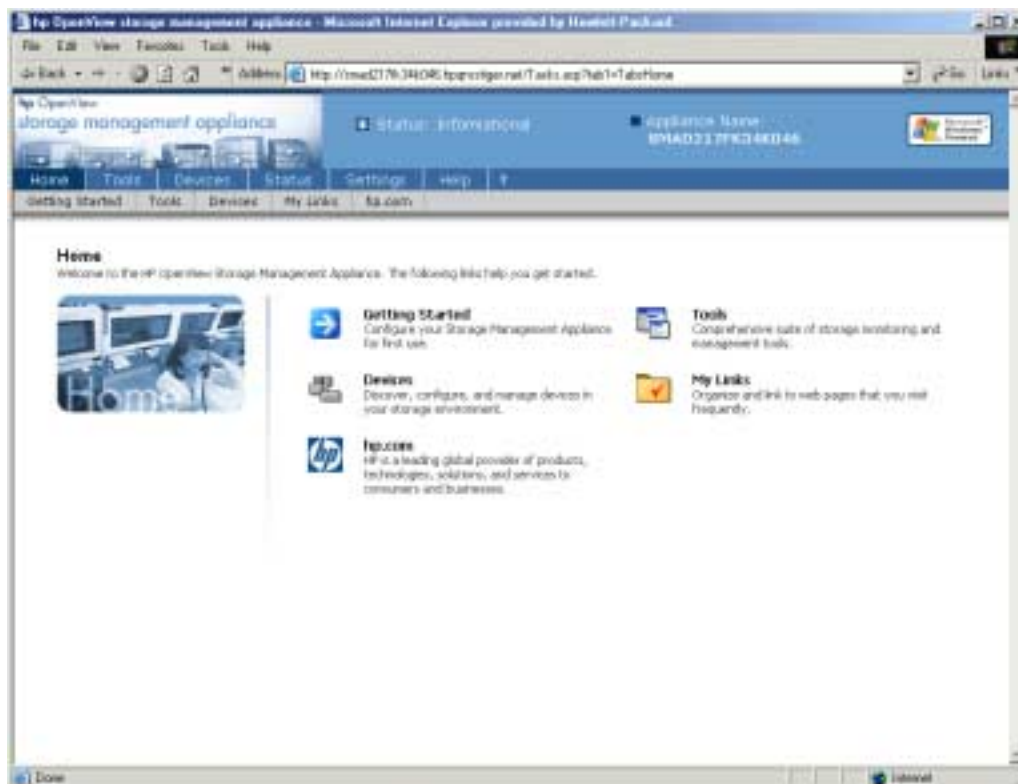
Individuals with administrator privileges on the Storage Management Appliance can change the default ports used for both the encrypted (SSL) and non-encrypted data exchange.

In addition to the built-in security features of the Storage Management Appliance Software, you can add the Storage Management Appliance to a domain. Adding your Storage Management Appliance to a domain enhances security because the user and group accounts are subject to the security policies set by the domain administrator and enforced by the Windows network.

Navigating the user interface

The Storage Management Appliance provides a centralized point for managing and monitoring storage elements.

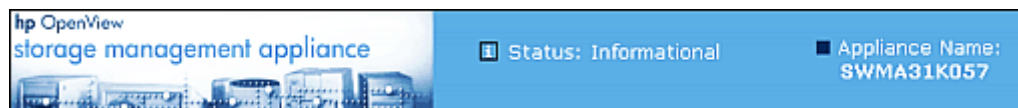
The user interface is divided into the Session and Content panes.



Session pane

The Session pane is located in the upper portion of each page and consists of an informational section and the navigation section.

The informational section displays the Appliance name and system status.

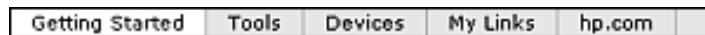


The navigation section contains two navigation bars—primary and secondary. Use the primary navigation bar items to open the primary pages (Home, Tools, Devices, Status, Settings, and Help).



These primary navigation choices are available from every page of the interface.

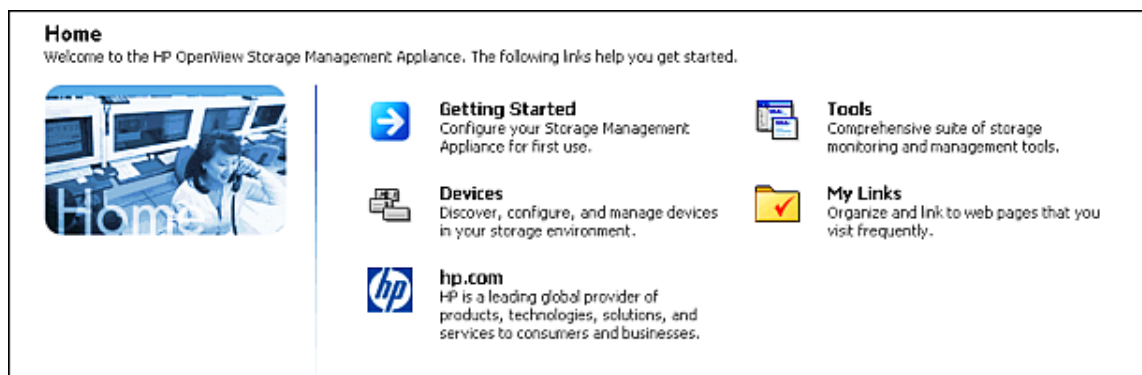
Use the secondary navigation bar to choose an option available for the current primary item.



Options on the secondary navigation bar change depending on which primary item you select. The secondary navigation bar items provide access to the Storage Management Appliance features. Your ability to access features depends on your assigned privilege level.

Content pane

The Content pane contains information formatted as a links page or as a task page.



A links page contains several links that provide access to major feature sets.

Task pages allow you to complete a specific function and can be formatted as a wizard set, a properties page, or a list table with task buttons.

Note

Go to the HP web site and select *Storage* → *Software* → *Storage Management Appliance* → *Technical Documentation* for the User Guide for details on accessing and using the pages that follow.

Using the Home Page

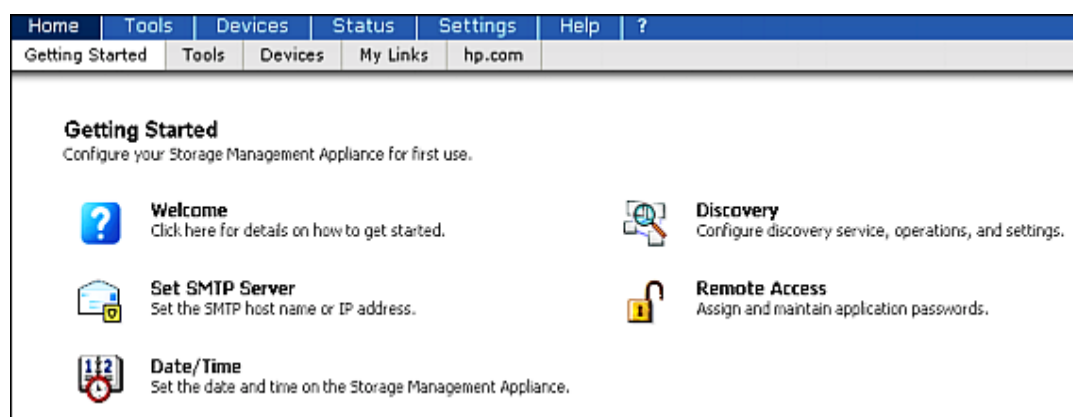
The Home page depicted earlier is the screen that displays when logging into the Storage Management Appliance. You can always return to that page by selecting *Home* from the primary navigation bar.

To access the links for the Home page, click the text, the icon or the secondary navigation bar.

The following links can be accessed from the *Home* page.

Getting Started

The Getting Started page provides a convenient set of links to help you prepare your Storage Management Appliance Software for use. Most links on the Getting Started page are also available from the Settings page.



To set up the Storage Management Appliance Software for first use, you may need to adjust the following initial settings:

- **Welcome** -- Display a Help page that provides information about the other links on the Getting Started page.
- **Discovery** -- Sets up and schedules a discovery so that your Storage Management Appliance Software is aware of all your storage elements.

- **Set SMTP Server** -- Specifies the mail server used for sending email notifications to users when certain events occur. This setting is only necessary when you use the Storage Management Appliance notification features.
- **Remote Access** -- Creates and manages access profiles used by one management application to initiate communication with another management application.
- **Date/Time** -- Sets the date and time for the Storage Management Appliance Software.
- **Migrate Notification Setting** -- Migrates previous notification settings to the updated Storage Management Appliance. This option is available only when you are upgrading an earlier version of the Storage Management Appliance software that was configured for notification.

Tools

The link is the same as from the primary navigation bar and will be discussed in the following sections.

Devices

The link is the same as from the primary navigation bar and will be discussed in the following sections.

My Links

The My Links page allows you set up links to Internet or intranet sites you visit frequently. These links are specific to your user logon and display whenever you log on regardless of your physical location. To add, remove, or modify your link, click *Configure* and follow the instructions provided by the wizard.

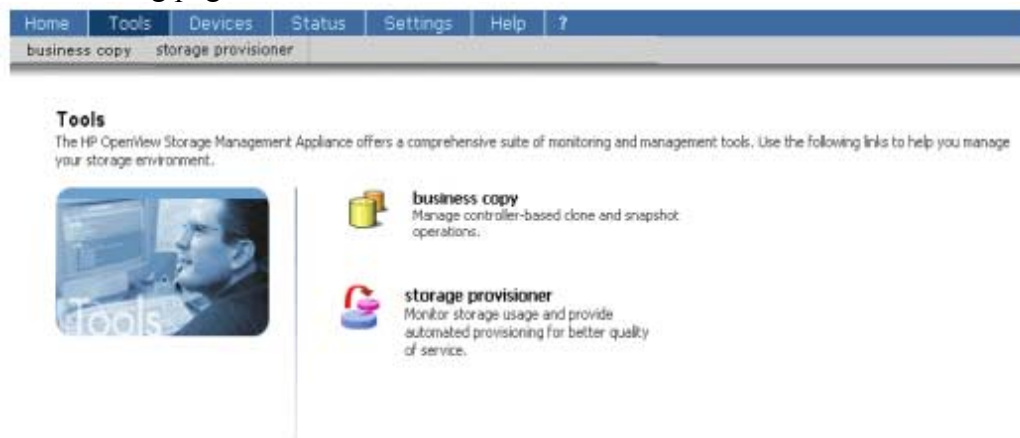


hp.com

This option links you directly to the HP OpenView Storage Management Appliance Overview and Features page on the HP website.

Using the Tools page

Using either the primary or secondary navigation bars, clicking *Tools* will display the following page.



The Tools screen displays the optional software loaded on the appliance. A user assigned the administrator or operator privilege level can launch any value-added HP storage management application displayed on the Tools page.

Using the Devices page

Click Devices in the primary navigation bar to display the following page.

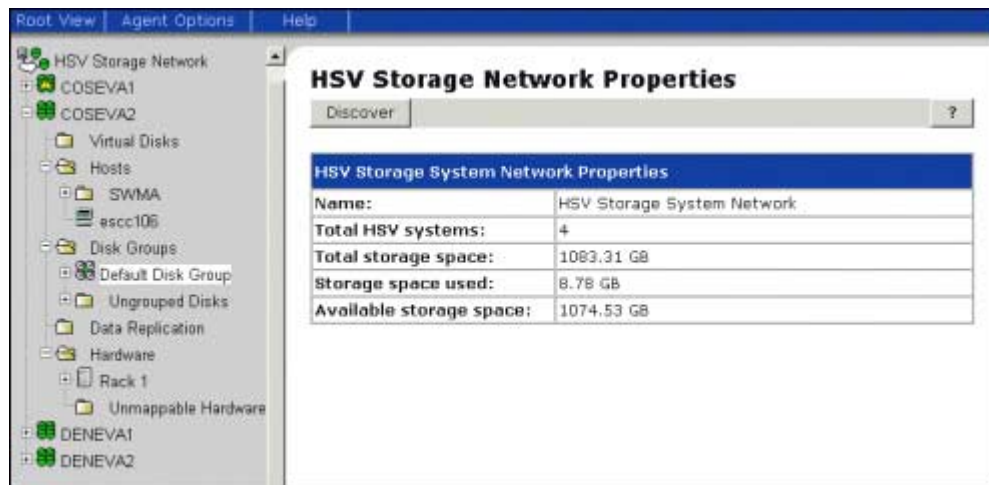


Discovered Devices

Lists devices found by all IP discoveries.

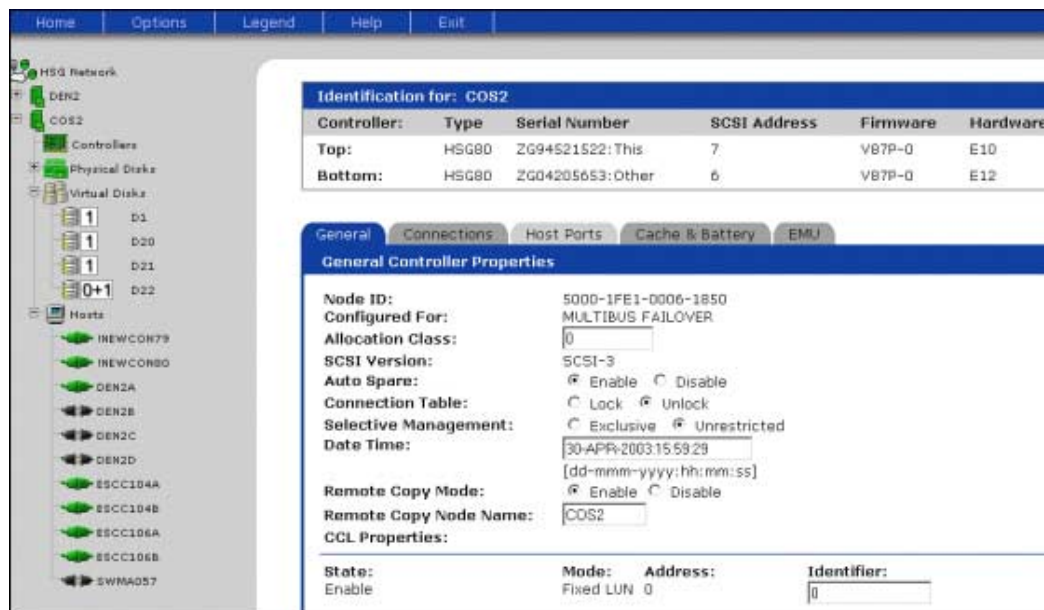
Command view eva

Launches the GUI for managing and configuring the HSV controller-based RAID arrays. Click *command view eva* to display the following page.



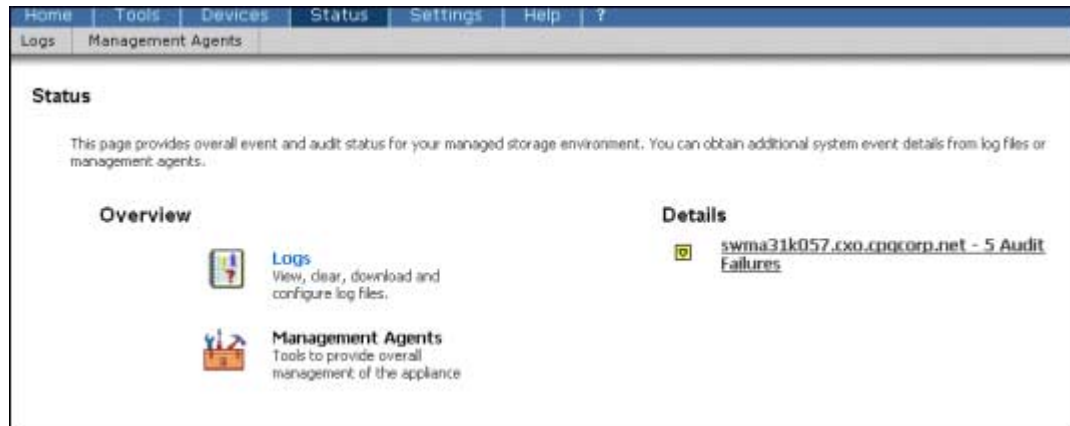
HSG element manager

Launches the element manager for managing and configuring the HSG controller-based RAID arrays. Click *HSG element manager* to display the following page.



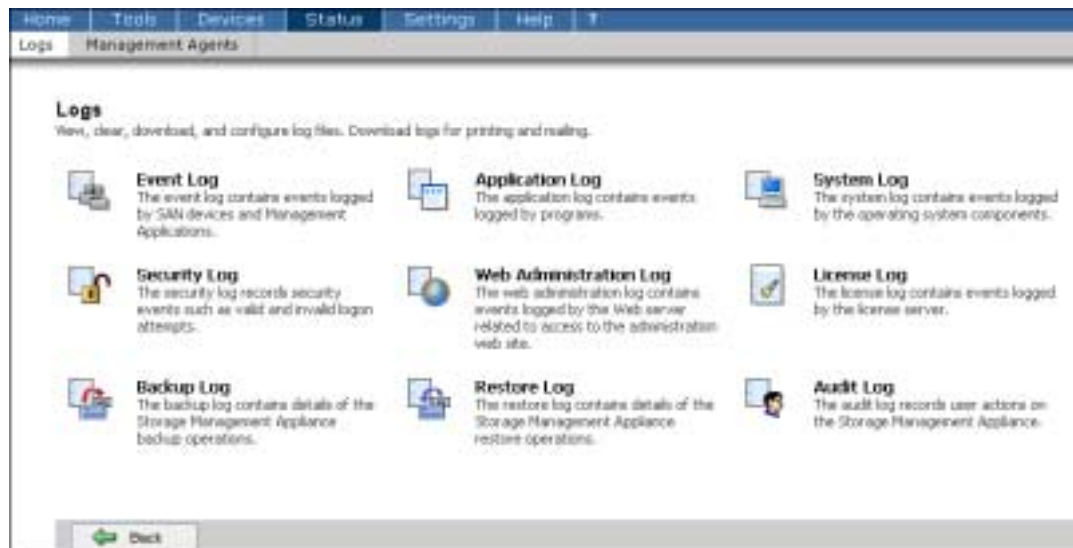
Using the Status pages

Click *Status* on the primary navigation bar to display the following page.



Logs

Click *Logs* on the secondary navigation bar or the Content pane to display the following page.



The Storage Management Appliance maintains the following logs that you can use to review system operation:

- **Event Log** — Contains events reported by the Storage Management Appliance, its core components and services, and by SAN devices and storage management applications.
- **Application Log** — Contains events reported by applications or programs. Each application determines which events to record. Management features are similar to the Event Log.
- **System Log** — A Windows operating system log containing events logged by the operating system components. For example, the log can report that a driver or other system component failed to load during startup. Management features are similar to the Event Log.
- **Security Log** — A Windows operating system log containing security events such as valid and invalid logon attempts and events related to resource use such as creating, opening, or deleting files. Management features are similar to the Event Log.
- **Web Administration Log** — A Windows operating system log containing a list of separate log files. These files contain events that are logged by the Web server about access to the administration website. Management features are similar to the Backup Log.
- **License Log** — Contains events logged by the Storage Management Appliance license server. You can download the file to your computer.
- **Backup Log** — Contains a list of separate log files—one for each backup operation. After selecting a file you can view the contents or download the file to your computer.
- **Restore Log** — Contains a list of separate log files—one for each restore operation. After selecting a file you can view the contents or download the file to your computer.

Note

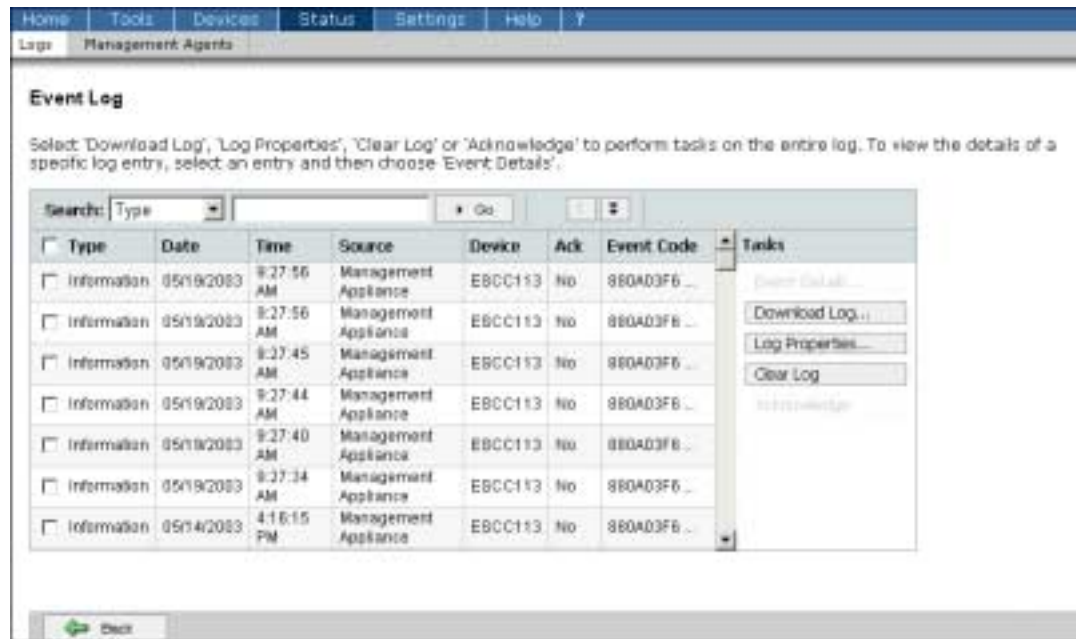
The Backup and Restore logs record only those backup and restore processes completed with the Storage Management Appliance features, not those completed with another backup application.

- **Audit Log** — Used to record user actions on the Storage Management Appliance. The system logs all user actions.

Event and Audit Logs

The Event and Audit logs record Storage Management Appliance events of different types. The Event Log contains information about device or application events and the Audit Log contains information about the activities of particular users. These two logs offer similar management features.

Click *Event Log* in the Content pane to display the following page.



The basic display for the Event and Audit Log pages uses a list table with table pages that each holds a maximum of 100 log entries. Information for each event displays in the following columns for each log.

| Event Log | Audit Log |
|--------------------------|--------------------------|
| Type | Type |
| Date | Date |
| Time | Time |
| Source | User |
| Device | Device |
| Acknowledged (Yes or No) | Category |
| Event Code | Acknowledged (Yes or No) |
| | Event Code |

Hold the cursor over an event code to display a short pop-up description.

The system automatically assigns an unacknowledged status when first recording an event in either log. As a user assigned the Administrator privilege level, you can change the status of any event to *Acknowledged = Yes* to indicate the event cause has been examined and no further action is required. The Storage Management Appliance displays system status information in the Session pane and on the Status page based on unacknowledged entries in the Event and Audit logs.

Both the Event Log and Audit Log pages have the following Tasks buttons.

- **Event or Audit Details** — Displays a Log Details page with complete information about an entry selected on the Event Log or Audit Log page. The Log Details page contains up and down arrow buttons for displaying detail for the log entry immediately above or below the entry currently displayed.
- **Download Log** — Displays a Download Event Log or Download Audit Log. Use this page to download the existing log file to your computer as a tab delimited text file (.log) or a comma delimited text file (.csv).

The screenshot shows a web application interface with a top navigation bar containing links: Home, Tools, Devices, Status, Settings, Help, and a question mark icon. Below this is a sub-navigation bar with 'Logs' and 'Management Agents'. The main content area is titled 'Download Event Log'. It contains the following text: 'Select the type of file you want to download and then choose Download. Select Back to return to the previous page without downloading a file.' There are two radio button options: 'Tab delimited text file(*.log)' which is selected, and 'Comma delimited text file(*.csv)'. At the bottom of the form is a button labeled 'Download Log...'.

- **Log Properties** — Displays the Event Log Properties or Audit Log Properties page. Both pages have the same features as shown in the following Event Log Properties page below.

The screenshot shows the 'Event Log Properties' page. At the top is a navigation bar with tabs: Home, Tools, Devices, Status, Settings, Help, and a question mark icon. Below this is a sub-tab bar with 'Logs' and 'Management Agents'. The main content area is titled 'Event Log Properties'. It contains the following sections:

- Log Size**: Displays '0.30 MB (304 KB)'.
- Select a Maximum Log Size**: A text input field containing '256' followed by a spin button and 'MB'.
- When the maximum log size is reached**: Three radio button options:
 - ☐ Overwrite events as needed
 - ☒ Overwrite events older than days.
 - ☐ Do not overwrite events
- Select the types of events to display**: Three radio button options:
 - ☒ Acknowledged and UnAcknowledged Events
 - ☐ Acknowledged Events Only
 - ☐ UnAcknowledged Events Only

The system displays the existing log size in megabytes as read-only information. You can change the maximum log size by selecting a value using the up and down arrows or typing a value directly in the field provided.

Note

Any change in maximum log size becomes effective only after you clear the log.

The Storage Management Appliance generates the following log events as the two logs approach the maximum size:

- 880A02BD - Warning - Event Log is 80% full
- 880A02BF - Warning - Audit Log is 80% full

The Storage Management Appliance generates the following Application log events when the logs reach maximum size:

- 880A02BE - Critical - Event Log is full
- 880A02C0 - Critical - Audit Log is full

Select one of the following options to specify how the system handles new entries when the log reaches the maximum size.

- **Overwrite . . .** —The system overwrites existing log entries and no new entries are lost.
- **Overwrite events older than . . .** —Use the up and down arrows to specify a number of days or type a value directly in the field. Should there be no entries older than this value when the log reaches maximum size, new entries are lost.
- **Do not overwrite . . .** —Should the log reach maximum size, all new entries are lost.

Select what events the system displays on the Event Log or Audit Log page from the following options.

- ♦ Acknowledged and Unacknowledged
- ♦ Acknowledged only
- ♦ Unacknowledged only
- **Clear Log** — Deletes all entries from the active log after you respond positively to a request for confirmation. To save existing log entries for future reference you must download the current log.
- **Acknowledge** — Changes the status of selected log entries to acknowledged after you respond positively to a request for confirmation.

While users with Administrator privileges can use all log features, users assigned the Operator privilege level can only view and download the Event Log.

You can also click on the listed Event under Details on the Status page and the page will be refreshed as shown below. Clicking on View Events will display a Log page and clicking Acknowledge Events will acknowledge the referenced Event(s).



Management Agents

Click Management Agents to view information about the Storage Management Appliance's hardware elements (as shown below).

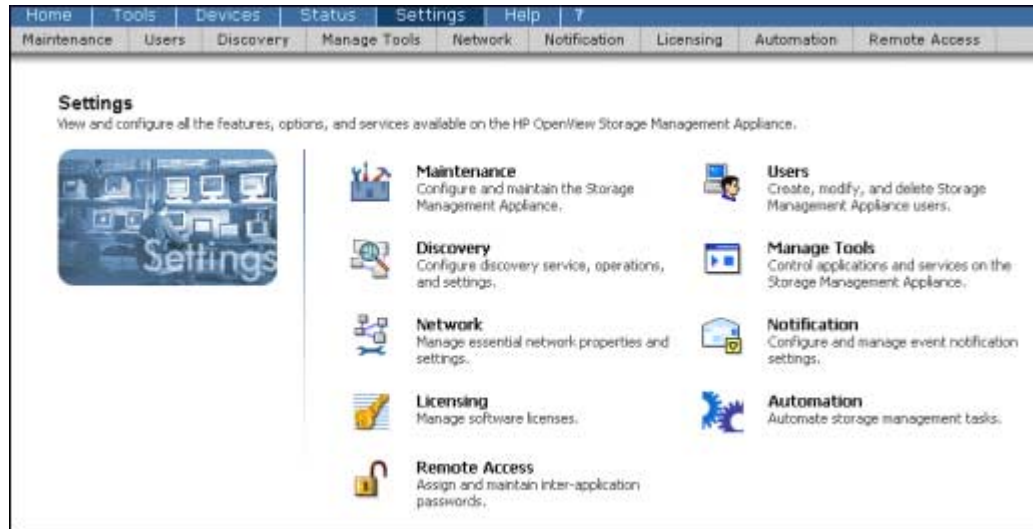


Management Agents operate on servers and workstations, performing in-depth monitoring of the system's state by collecting and measuring system parameters. These parameters indicate the current state of subsystems by counting the occurrence of particular events or monitoring the state of a critical function. For example, Management Agents can count the number of read operations performed on a disk drive or determine if the cooling fan is operating.

Management Agents provide information to management applications, such as Insight Manager, and generate alarm notifications if significant changes occur in the fault or performance aspect of system operation. Information is delivered to and from the Management Agents by the industry-standard Simple Network Management Protocol (SNMP).

Using the Settings Pages

Click Settings in the primary navigation bar to display the following page and to view and configure features, options, and services available on the Storage Management Appliance.



Maintenance

You can use the features available on the Maintenance page to complete the following administrative tasks.



Install Software

You can install any value-added HP storage management application on the Storage Management Appliance using the installation wizard. You purchase these optional management applications separately. The installation process registers each application with the Storage Management Appliance Software so the Storage Management Appliance receives notification events and captures additional information in the system logs.

Use this procedure to install a storage management application:

1. Click *Install Software* to display the installation wizard welcome page. If you are installing an update to a previously installed application, you need to ensure that its services are stopped before proceeding. Use the stop feature on the Manage Tools page to stop the application.
2. Choose one of the following methods to install the update:
 - ♦ **CD-ROM Drive**—Place the installation file at the root level on a CD and insert the update CD-ROM into the CD-ROM drive.
 - ♦ **FTP Server**—Enter the requested information.
 - ♦ **Local Disk**—Copy the installation file (SWP) to the *C:\Compaq\swpinstkits* directory on the Storage Management Appliance, **not** the system from which you browse to the appliance.

3. Click *Next*. The page displayed depends on the media type selected in step 2. You must either enter FTP Server information or select an SWP file from the drop-down list.
4. (The CD-ROM method skips this step.) Click *Next* to start a file retrieval process. This process can take some time to complete depending on the media type selected in step 2.
5. Select the application from the drop-down list, and then click *Next* to start the installation process. The installation program displays a progress bar showing the state of completion.

Should installation of an application fail for any reason, the Storage Management Appliance does not allow you to attempt another installation during the one-hour period following a failed attempt. Should you attempt another installation during this period, the system displays an error message saying a previous installation is in progress.

Certain antivirus and backup applications have been tested and are supported to run on the Storage Management Appliance.

Note

Do not attempt to use the Storage Management Appliance installation wizard to install these antivirus and backup applications.

The following options from the Maintenance page use wizards that are self-explanatory except as noted.

Remove Software

Follow the wizard to remove storage management applications.

Date/Time

Set the date and time or select an option to *Synchronize the Appliance Date and Time settings* with an SNTP time server of your choice. Then select a synchronization period of every 8 hours, 1 day, 2 days, 3 days, or 7 days.

Shutdown

Restart, shutdown, or schedule a shutdown or restart.

Backup and Restore

Provides a built-in capability to backup and restore the database and application files to and from a network share drive. You have the option to use these features or another backup and recovery system. Instructions for installing supported backup applications are presented on the Storage Management Appliance website.

Language

Change the language used by the Storage Management Appliance.

Set SNMP Server

Set the SMTP host name or IP address.

Users

The Storage Management Appliance Software requires each user to complete a logon process. An administrator can assign each user a user name and password plus a privilege level. The assigned privilege level determines what pages the person can view and what actions they can perform.

| Name | Domain/Machine Name | Account Status | Tasks |
|---|---------------------|----------------|--|
| <input checked="" type="checkbox"/> Administrator | SNMA31KJ57 | Enabled* | New... Import... Delete Set a Password... Properties... Notification... |
| | | | |
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* indicates Current User

The system administrator or any user assigned the Administrator privilege level can add (click New) or Delete users as well as Set a Password and edit the Properties of any existing user including the assigned privilege level. They can also set up or modify event Notification settings for the selected user.

An Administrator can also make a Windows domain user a Storage Management Appliance user by using the Import button. You can only import users from the domain where the Storage Management Appliance is located.



Note

The Import button is only available when the Storage Management Appliance is part of a domain.

The import feature is a convenient way to add a Storage Management Appliance user with the same user name and password the person uses to access their local network.

Discovery

The Storage Management Appliance uses a discovery process to identify devices and applications operating in your storage network environment. You can create any number of discovery processes and each process can have a different set of parameters. Each process is referred to as a *discovery*.

You can configure new discoveries, start discoveries, or modify properties of existing discoveries. Select a name entry and then choose a task. To create a new discovery, click *New*.

| Name | Enabled | Running | Last Run | Next Run | Tasks |
|---|---------|---------|-----------------------|-----------|---|
| <input checked="" type="checkbox"/> Local SAN Discovery | Yes | No | 3/28/2003 11:13:24 AM | On demand | New... Delete Properties... Start Discovery Enable Disable |

You can schedule a discovery to run at regular intervals or to run only on demand (you start the process manually).

To find all devices in your SAN you must use two discovery types—IP discoveries and SAN discoveries.

You can define any number of IP discoveries that query SNMP agents at specified IP addresses. An IP discovery can identify any device connected to the LAN with an enabled SNMP agent. Such devices include host computers, Fibre Channel switches and other Storage Management Appliances.

The Storage Management Appliance is also connected to the SAN fabric by means of a fabric switch. Some devices within the SAN fabric have no SNMP agent or LAN connection. The Storage Management Appliance uses a SAN discovery to identify storage elements connected to the local SAN. A SAN discovery identifies HSG and HSV controllers (or controller pairs) as well as the Storage Management Appliance itself.

This local SAN discovery is preset on the Storage Management Appliance and runs by default during the update. It is set to run on demand and must be run whenever you add controllers or change the Storage Management Appliance name.

If you use Command View EVA to manage EVA storage elements in your network, you must use the Remote Access feature on the Settings page to create a user name and password before the HSV can be identified by a SAN discovery.

Note

To stop a running discovery, you must stop and restart the Storage Management Appliance services using the Manage Tools page. Restarting the Storage Management Appliance stops all running discoveries.

The Storage Management Appliance automatically performs an initial discovery when updating a Storage Management Appliance to a new software version.

Manage Tools

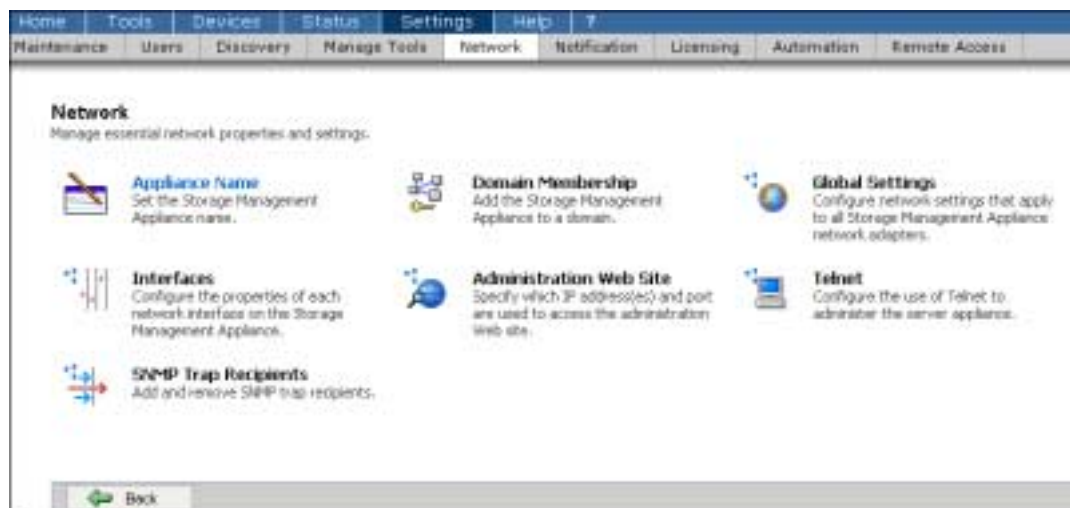
The Manage Tools page allows you to start or stop applications and view selected properties. Choose a single application and click *Properties* to display a list of individual services associated with the application. You cannot stop individual services associated with an application.

The screenshot displays the 'Manage Tools' interface. At the top, there is a navigation bar with tabs: Home, Tools, Devices, Status, Settings, Help, and ?. Below this is a secondary bar with tabs: Maintenance, Users, Discovery, Manage Tools (selected), Network, Notification, Licensing, Automation, and Remote Access. The main content area is titled 'Manage Tools' and includes the instruction 'List, start and stop services and applications'. Below this is a search bar with a dropdown menu set to 'Application' and a search button. The main table lists the following applications:

| Application | Version | State | Tasks |
|--------------------------|-----------|---------|---------------|
| Management Appliance | 2.00 | Running | Start... |
| License Manager | 1.02 | Running | Stop... |
| continuous access | 1.0.0.0 | Running | Properties... |
| command view eva | 3.0.0.386 | Running | Configure... |
| Command View EVA V3.0 | 3.0.0.373 | Running | |
| Automation Manager | 2.00 | Running | |
| HSG Element Manager | 1.0.4.0 | Running | |
| Compaq Management Agents | 6.20.0.0 | Running | |

Network

The links on the Network page let you manage the network settings of the Storage Management Appliance.



Follow the instructions in the wizards to change the network settings.

Appliance Name

As the system administrator, you can rename the Storage Management Appliance to a name that suits your needs.



Caution

HP recommends that you always use the Storage Management Appliance Software to complete operations on your Storage Management Appliance. Do not use the Windows Control Panel System or other Windows features to perform operations, as doing so can lead to unpredictable results.

If the Storage Management Appliance is a domain member, the device can only be renamed within the existing domain and only by a person who is in the Domain Administrator group for that domain.

Consider the following dependencies when renaming your Storage Management Appliance:

- If you have an application installed that is dependent on the Storage Management Appliance name, you cannot change the system name. A message at the bottom of the page tells you if an application is installed that prevents you from changing the Storage Management Appliance name.
- You must run the built-in local SAN discovery to have the new name recognized. If you are using DHCP, you must run the local SAN discovery after the DNS server has been updated.

Note

If you used a previous version of the Storage Management Appliance Software that was configured to send event notifications, you must migrate all previous notification settings before changing the Storage Management Appliance name. Migration cannot be done after changing the system name.

Domain Membership

The Storage Management Appliance can be a member of only one domain at any given time.

Global Settings

Use this page to configure network DNS Resolution, modify the TCP/IP Hosts file and enable or disable LMHOSTS lookup.

Interfaces

Configure the properties of each network interface on the Storage Management Appliance.

Administration Web Site

Select which IP addresses and encrypted and non-encrypted ports can be used to access the administration web site.

Telnet

Enable or disable telnet access to this appliance.

SNMP Trap Recipients

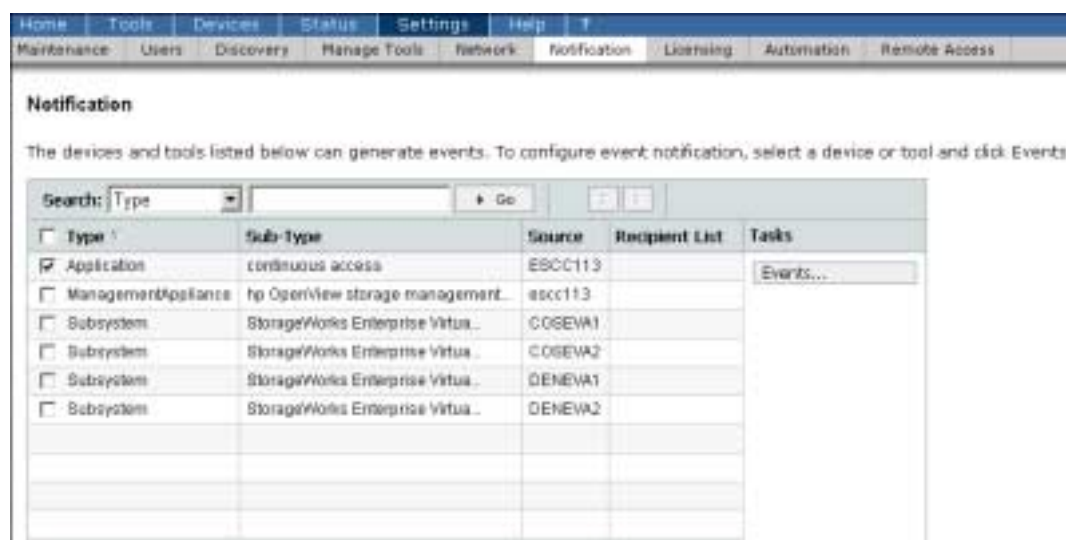
Add and remove SNMP trap recipients.

Notification

As a user assigned the Administrator privilege level, you can use the Storage Management Appliance Software to set up event notifications in two ways:

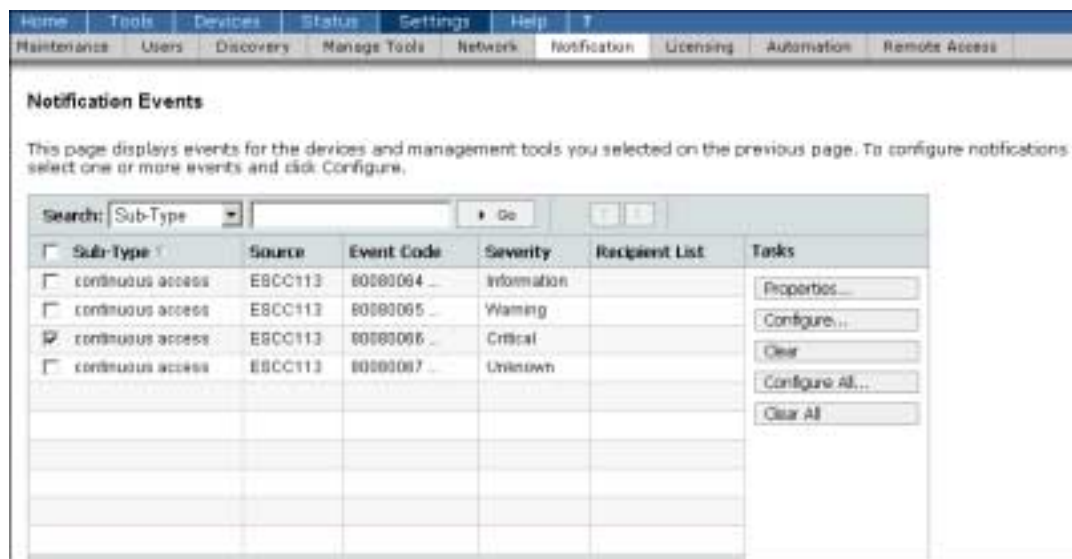
- Select a discovered device or registered application and specify how each event type should be handled. In this process you can specify both SNMP trap forwarding and email notification for each supported event type generated by the device or application.
- Select a user and specify the event types that generate an email notification message to that person. Review the supported event types for all available devices and applications and select those that are to generate email messages to the selected user.

On this appliance, the following devices and tools can generate events.



| Type | Sub-Type | Source | Recipient List | Tasks |
|---|-----------------------------------|---------|----------------|-----------|
| <input checked="" type="checkbox"/> Application | continuous access | ESCC113 | | Events... |
| <input type="checkbox"/> ManagementAppliance | hp OpenView storage management... | escc113 | | |
| <input type="checkbox"/> Subsystem | StorageWorks Enterprise Virtua... | COSEVA1 | | |
| <input type="checkbox"/> Subsystem | StorageWorks Enterprise Virtua... | COSEVA2 | | |
| <input type="checkbox"/> Subsystem | StorageWorks Enterprise Virtua... | DENEVA1 | | |
| <input type="checkbox"/> Subsystem | StorageWorks Enterprise Virtua... | DENEVA2 | | |
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To configure event notification, select a device or tool and click *Events*.

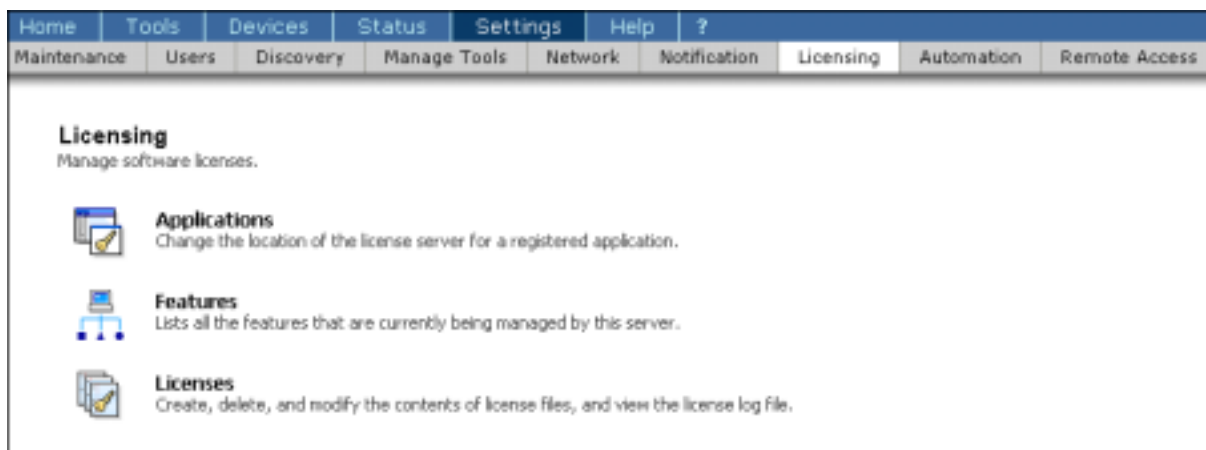


On the new page, select an *Event*, click *Configure*, and then select:

- Users
- Trap recipients
- Set the time to not receive duplicate events
- Enable or disable additional event logging (such as adding to Windows Event Viewer).

Licensing

The licensing feature enables you to control installed applications that use the Globetrotter FLEXlm licensed manager software. The licensing feature allows you to manage the number of people using each application so you stay within the limits of the license agreement.



Use the links on the Licensing page to display the following pages:

- **Applications** — Lists existing applications with the assigned license server for each application. Select an application and click *Properties* to change the assigned license server.
- **Features** — Lists existing features and allows you to display detailed information for a selection.
- **Licenses** — Lists existing license files and option files. You can use features on this page to view, create, modify, and delete license files.

Automation

The Automation Manager is a web-based enterprise storage tool for managing storage area networks. Automation Manager automates storage tasks using predefined policies that are provided with the application as Perl scripts.

The Automation Manager allows you to develop policies consisting of event and action scripts that can be run on any number of hosts.

Event scripts run to monitor a system by comparing current conditions with established thresholds or identifying activities that warrant some maintenance action. Policies poll event scripts at regular intervals that you specify.

Action scripts run when required to complete an appropriate maintenance action.

The Automation Manager comes with a number of predefined scripts that you can use to create a variety of policies. Those predefined scripts are described in the following table:

| Script name | Type | Operating systems | Description |
|------------------------------------|--------|--|--|
| AutoCleanDir.pl | Action | Windows 2000 and Windows NT | Automatically cleans the temp directory after a specified date. |
| BackupAndClearAllEventLogs.pl | Action | Windows 2000 and Windows NT | Automatically backs up and clears all event logs on the associated hosts. |
| BackupAndClearSpecifiedEventLog.pl | Action | Windows 2000 and Windows NT | Automatically backs up and clears specific event logs on the associated hosts. |
| CheckControllerHealth.pl | Event | Windows 2000 and Windows NT | Checks the health status of the dual controller on an HSG80 controller (requires Command Scripiter). |
| CheckDiskUsageFromMountPoint.pl | Event | HP-UX, AIX, Sun Solaris, Tru64 UNIX | Checks file, directory, and mount point disk use. |
| GetDriveSpaceInfo.pl | Event | Windows 2000 and Windows NT | Gets the disk type, volume name, disk space, free spaces, and total usage from the remote and fixed disks, CD-ROM, and RamDisk. The script then calculates the usage percentage. An asterisk (*) in front of the usage percentage indicates that the usage percentage is over the 80% threshold. |
| QueryEventLog.pl | Event | Windows 2000 and Windows NT | Queries all event logs on the associated hosts. |
| ReturnValue.pl | N/A | All | Contains all exit status information for Automation Manager. |
| RemoveFilesInFolder.pl | Action | HP-UX, AIX, Sun Solaris, Tru64 UNIX | Removes files that are a specified number of days old. |
| RunHSG80MacroCommands.pl | Action | Windows 2000 and Windows NT | Runs specified HSG80 commands. The commands must be in a text file (requires Command Scripiter). |
| RunUnixCommand.pl | Action | HP-UX, AIX, Sun Solaris, Tru64 UNIX | Runs a specified UNIX command. |
| RunOpenVMSCommand.pl | Action | OpenVMS | Runs a specified OpenVMS command. |
| CheckBCStatus | Event | Windows 2000 (Management Appliance Only) | Checks for the status of Business Copy jobs. |
| ExecuteBCJob | Action | Windows 2000 (Management Appliance Only) | Runs a Business Copy job. |

You can also use application features to import scripts developed to meet local needs or export existing scripts for modification.

In addition, you can create your own management scripts to:

- React to storage management situations such as clearing disk drives, log files, or temp files when they reach a predetermined threshold, for example, disk use or file age.
- Set thresholds for free space requirements for file systems, volumes, and RAID sets.
- Set quotas for users, devices, and folder growth.
- Control application growth, for example, moving segments of the data store to different drives to distribute the load across the drives.

Note

Refer to the *Automation Manager Script Development Guide* for detailed information about script development.

When you start the Automation Manager, the system displays the *Policies* page.



The primary navigation bar of the Automation Manager has the following options:

- **Policies** — allows you to manage Automation Manager policies, which includes adding, modifying, viewing, and controlling (deleting, stopping, restarting, pausing, or continuing) the policies.
- **Settings** — allows you to manage hosts, host agents, scripts, and calendar templates.
- **Reports** — allows you to generate status reports of each process within all submitted policies.
- **Help** — provides help pages.

Remote Access

Using the Remote Access feature, you can view and manage access information so that applications on the Storage Management Appliance can communicate with applications on remote systems. These remote systems are systems that have been discovered by the Storage Management Appliance. This feature provides a secure method of saving access information on the local Storage Management Appliance.

Manage Application Passwords

Manage access information used by local applications to communicate with remote applications.

Search: Host

| <input type="checkbox"/> Host | Application | Domain Name | Username | Tasks |
|---|---------------------|-------------|---------------|--|
| <input checked="" type="checkbox"/> ES0C113 | continuous access | | | <input type="button" value="New..."/> |
| <input type="checkbox"/> ES0C113 | H50 element manager | | administrator | <input type="button" value="Delete"/> |
| <input type="checkbox"/> ES0C113 | HSV element manager | | administrator | <input type="button" value="Properties..."/> |
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When the Storage Management Appliance discovers hosts and devices, it creates a preliminary access record for each application on the remote system. Complete the access record by providing authorization information, as needed.

Only one access record is necessary for each host and application pair. For each application on each discovered host, you can specify a domain, a user name, and a password. This information comprises the access record that is stored and used by all applications on the Storage Management Appliance.

Some remote applications do not require all of the information, such as a domain name, in order to be accessed. Consult the application documentation to determine the specific requirements.

Using Help

The primary navigation bar has two help options to find information quickly.

The *Help* button opens the Storage Management Appliance help system much like a typical Windows help page and provides three navigation tabs—Contents, Index, and Search.

Clicking the question mark (?) displays a context-sensitive help topic describing the current page, as shown below.



Learning check

1. List five software components that provide the Storage Management Appliance basic functionality.

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2. List two storage software components that provide the Storage Management Appliance added functionality.

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3. What are the default passwords for the Web agent, the operating system and the RILOE board on the Storage Management Appliance?

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4. Name the three security features that can be used with the Storage Management Appliance.

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5. What link from the primary navigation bar is used to access optional software loaded on the Storage Management Appliance?

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6. HP storage arrays are accessed from what link on the primary navigation bar?

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7. Event logs are displayed by going first to what link on the primary navigation bar?

.....

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8. What link from the Settings page is used to install software?

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.....

.....

9. Name the three methods to install software.

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10. What two discovery types must you use to find all devices in your SAN,?

.....

.....

.....

11. List and describe two features Automation Manager provides to manage your storage operations.....
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-

HP OpenView Storage Management Appliance — Troubleshooting

Module 3 Addendum

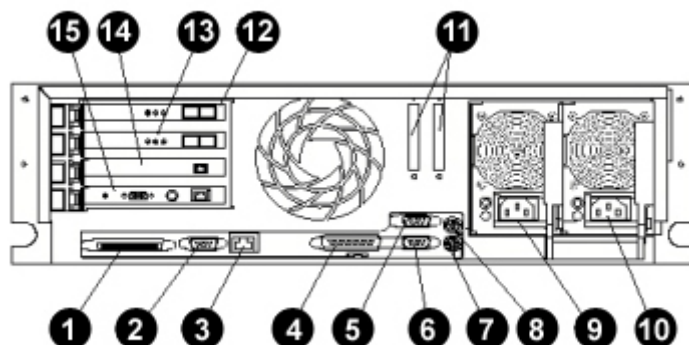
NOTE: Names of the interfaces frequently change; therefore, apply the same type of action to the appropriate new interfaces if out-of-date interfaces are referenced.

Objectives

After completing this module, you should be able to:

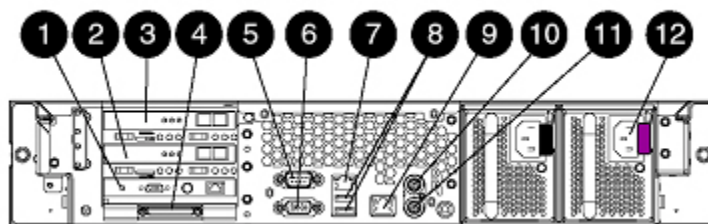
- Identify the initial steps to take when troubleshooting the HP OpenView Storage Management Appliance.
- Use standard troubleshooting techniques to identify a problem with the Storage Management Appliance and determine its solution.
- Identify key troubleshooting areas for applications that reside on the Storage Management Appliance.

Operational status



Rear panel on the Storage Management Appliance

| Number | Connector or LED | Number | Connector or LED |
|--------|-------------------------------|--------|--|
| 1 | External SCSI connector | 9 | Hot-plug redundant power supply |
| 2 | Video connector – not used | 10 | Hot-plug power supply |
| 3 | RJ-45 Fast Ethernet connector | 11 | External SCSI connectors |
| 4 | Parallel connector | 12 | Fibre Channel adapter (only one supported) |
| 5 | Serial connector B | 13 | Second Fibre Channel adapter |
| 6 | Serial connector A | 14 | Modem |
| 7 | Keyboard connector | 15 | Service Access board |
| 8 | Mouse connector | | |

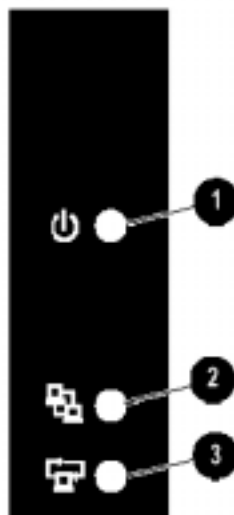


Rear panel on the Storage Management Appliance II

| Number | Connector or LED | Number | Connector or LED |
|--------|--|--------|---------------------------------|
| 1 | Service access board | 7 | RJ-45 Fast Ethernet connector |
| 2 | Fibre Channel adapter (only one supported) | 8 | USB ports |
| 3 | Second Fibre Channel adapter | 9 | RJ-45 Fast Ethernet connector |
| 4 | External SCSI connectors | 10 | Mouse connector |
| 5 | Serial connector A | 11 | Keyboard connector |
| 6 | Video connector – Not used | 12 | Hot-plug redundant power supply |

System status LED indicators

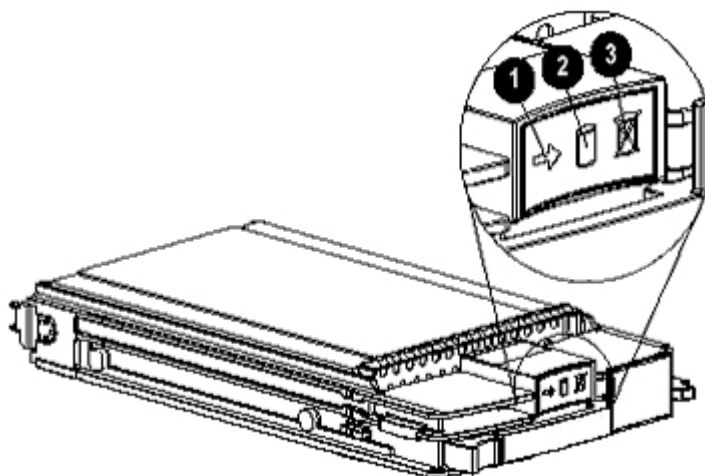
The following graphic and table illustrate the system status LEDs and describe their indications.



| Indicator | Status | Means | Action |
|--------------------------------|-----------------|--|--|
| ❶ Power on Standby Status | Green (On) | AC power is connected to the system, and the power supply is functioning properly. | If the green LED is on, no action is required. |
| | Amber (Standby) | System is in standby mode. | If the amber LED remains on, but should not be, it might indicate a power supply problem. Contact HP technical support. |
| | Off | No AC power is provided to the system. | Determine if the power should be off. If it should not be: <ul style="list-style-type: none"> Check the power cord to ensure it is plugged into a functional, grounded AC outlet. The power supply might not be operational. Contact HP technical support. |
| ❷ Integrated NIC link status | Green (On) | NIC is connected to the network. | If the green LED is on, no action is required. |
| | Off | NIC is not connected. | Determine if the green LED should be off. If it should not be: <ul style="list-style-type: none"> Ensure the cable is connected properly. Contact your system administrator to determine if there is a network problem. |
| ❸ Integrated NIC link activity | Green (On) | NIC is communicating with the network. | If the green LED is on, no action is required. |
| | Off | NIC is not communicating with the network at this time. | Determine if the green LED should be off. If it should not be: <ul style="list-style-type: none"> Contact your system administrator to determine if there is a network problem. It could indicate a problem in the controller. Contact HP technical support. |

Hard drive LED indicators

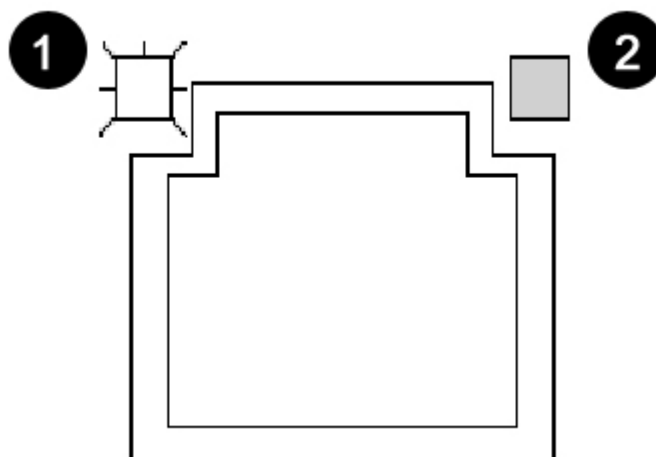
The following graphic and table illustrate the hard drive LEDs and describe their indications.



| Indicator | Status | Means | Action |
|----------------|----------|---|---|
| ❶ Activity | Flashing | Drive being accessed. | None required. |
| | Off | Drive on standby or off. | Determine if the green LED should be off: <ul style="list-style-type: none"> ■ If it should not be, reseal the hard drives by unplugging the drives from the drive carriage. ■ If the problem persists, contact HP technical support. |
| ❷ Power/Online | On | Indicates one of the following: <ul style="list-style-type: none"> ■ The hard drive is online. ■ Power to the hard drive. ■ The drive is a member of the RAID set. | None required. |
| | Flashing | The hard drive is being rebuilt or a RAID set is being created. | If the LED continues to flash for more than three hours, contact HP technical support. |
| | Off | The hard drive is offline. | If there is power to the Storage Management Appliance and the hard drive light is off, do one of the following: <ul style="list-style-type: none"> ■ Reseat the hard drives into the drive carriage. Check for bent pins before plugging in the drive. ■ If the problem persists, contact HP technical support. |
| ❸ Fault | On | A problem exists with the hard drive. | Contact HP Technical Support. |
| | Flashing | If flashing along with power/online LED, drive is part of a RAID set being created. | If the light continues to flash for more than three hours, contact HP technical support. |
| | Off | The hard drive is functioning normally. | None required. |

RJ-45 connector network status LED indicators

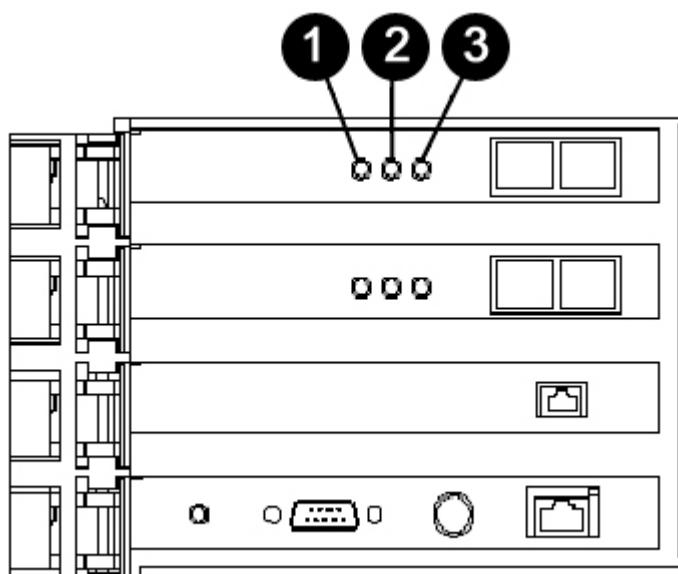
The following graphic and table illustrate the RJ-45 connector network status LEDs and describe their indications.



| Indicator | Status | Means | Action |
|------------|-----------------|---------------------|---|
| ❶ Activity | Off | No network activity | If in the off status for more than 30 minutes, do one of the following as required: <ul style="list-style-type: none"> Check to ensure no external cables are loose, frayed, or disconnected. Refer to the <i>Storage Software Storage Management Appliance Configuration Guide</i> to determine if your connection is correct. Contact your system administrator. If the problem persists, contact HP technical support. |
| | On or irregular | Network activity | None required. |
| ❷ Link | Off | No network link | Determine if this is an appropriate state. If not, then do one of the following as required: <ul style="list-style-type: none"> Refer to the <i>Storage Software Storage Management Appliance Configuration Guide</i> to determine if your configuration is correct. Contact your system administrator. If the problem persists, contact HP technical support. |
| | On | Linked to network | None required. |

Fibre Channel adapter indicators

The following graphic and table illustrate the Fibre Channel adapter LEDs and describe their indications.



| Indicator | Yellow LED | Green LED | State |
|------------|------------|-----------|------------------------------------|
| ❶ Activity | Off | | Normal. |
| | Flashing | | POST processing in progress. |
| ❷ Transmit | | Off | POST processing in progress. |
| | | On | Normal. Fiber network activity. |
| | | Flashing | Normal. No fiber activity. |
| ❸ Receive | | Off | Processing in progress. |
| | | On | Normal. Fiber network activity. |
| | | Flashing | Normal. No fiber network activity. |

Troubleshooting HP OpenView Storage Management Appliance software

The following describes corrective actions for troubleshooting Storage Management Appliance software problems.

| Problem | Action |
|---|---|
| Problems browsing. | Verify the following: <ul style="list-style-type: none"> ■ The Internet browser is supported. ■ The browser is configured properly. ■ The URL and port are correct. ■ If all of the above are configured correctly, contact HP technical support. |
| Unable to display Storage Management Appliance splash page. | Browse to the appliance by entering the following URL: <code>http://HOSTNAME:2301</code> . <ul style="list-style-type: none"> ■ Refer to the <i>Storage Software Storage Management Appliance Configuration Guide</i> to ensure your Storage Management Appliance is configured properly. ■ Restart the Storage Management Appliance. ■ If the problem still persists, contact HP technical support. |
| Storage Management Appliance software does not launch. | Reboot the Storage Management Appliance. If the problem still persists, contact HP technical support. |
| Storage Management Appliance folders do not display: | <ul style="list-style-type: none"> ■ Browse the Storage Management Appliance. ■ Check the status. ■ Log in as the administrator. ■ If the problem still persists, contact HP technical support. |

Troubleshooting Storage Management Appliance software login

If Storage Management Appliance software is not operational, check the login procedure:

1. Review the login procedures in the *Storage Software Storage Management Appliance Configuration Guide*.
2. Check your login user name and password.
3. If the user name and password are correct, but you are still not able to log in, refresh the browser by clicking the browser refresh button or relaunch your browser.

If these steps do not resolve the problem, refer to the advanced help section below. If the advanced help procedures do not resolve the problem, contact HP technical support.

Advanced help

This section describes additional troubleshooting procedures to resolve a problem in launching Storage Management Appliance software on the Storage Management Appliance. Use these procedures if you continue to enter your user name and password and Storage Management Appliance software still does not launch. If these procedures do not resolve the problem, contact HP technical support.

Deleting cookies from your browser

Delete the temporary Internet files and the cookie received from the Storage Management Appliance for your browser. If you cannot log in to Storage Management Appliance software with a user name and password *administrator*, refer to your browser documentation for information about deleting cookies.

Deleting files from the Web-Based Management (WBEM) directory

Use the following procedures to delete files from the WBEM directory:



Warning

Deleting files from the WBEM directory will take you back to the default login account.

1. Attach a terminal to the Storage Management Appliance (keyboard, mouse, and monitor).



Important

Ensure you connect the monitor to the service access board (or Remote Insight Board [RIB]) video connector. Do not connect the monitor to the onboard video connection.

2. From the Microsoft Windows Explorer window, go to the C:\HP\WBEM directory.
3. From the WBEM directory:
 - Delete the cache directory.
 - Delete any files with the extension .GFG, .DAT, or .ACL.
4. Reboot the Storage Management Appliance. The default login account should now be as follows:
User Name: administrator
Password: administrator
5. Disconnect the keyboard, mouse, and monitor.

Problems connecting to Storage Management Appliance

This section describes actions to take to resolve problems you might encounter when trying to connect to the Storage Management Appliance.

If your Internet browser does not launch:

1. Verify the Storage Management Appliance host name by pinging the Storage Management Appliance.
 - Ping host name SMAxxxxxxx or SWMAxxxxxxx.
 - Ping the IP address.
 - Contact your system administrator.
 - Contact HP technical services.
2. Verify that your Storage Management Appliance is operational. See the *Storage Software Storage Management Appliance Configuration Guide*.
3. Ensure that the browser is configured properly. See the *Storage Software Storage Management Appliance Configuration Guide* to determine how to configure the browser.
4. Verify that you have a supported browser.
5. Ensure that the Storage Management Appliance URL and port are correct. See the *Storage Software Storage Management Appliance Configuration Guide* to determine the URL and port settings.

Storage Management Appliance software navigation pane

This section describes the actions to take if the navigation tree does not display in the navigation pane after you log in to Storage Management Appliance software. It also describes the actions to take if the accounting and diagnostic links do not display in the Storage Management Appliance software navigation pane.

Navigation tree

If the navigation tree does not display in the navigation pane after positioning the cursor in the navigation pane, relaunch your browser. If the problem still persists, contact HP technical support.

Accounting and diagnostic links

If the accounting and diagnostic links do not display in the Storage Management Appliance software navigation pane, perform the following steps:

1. From Storage Management Appliance software, launch Appliance Manager.
2. In the Appliance Manager navigation tree, click *Services*.
3. In the Services table, check the application state.
4. If the application state is red, click *Start*.
5. The “Operation Successful!” message displays.
6. Click *OK*.
7. If the problem persists, call HP technical support.

Troubleshooting Storage Management applications



There are various storage management applications that can run on the HP OpenView Storage Management Appliance. This section provides procedures for troubleshooting some of the storage management applications.

Installing or updating applications

This section provides general troubleshooting information for installing or updating the storage management applications that run on the Storage Management Appliance. You can install or update storage management applications using a CD-ROM or the network. Both methods are discussed in this section.

After installing an application, the link displays in the navigation pane. If the link does not display:

1. Close and relaunch your browser.
2. If the link still does not display, launch Appliance Manager. Go to the Services screen to verify the status of the application:
 - If you see the application box, but its state is red, then the application is down. Restart the application.
 - If you do not see the application, reinstall the application.
 - If the application box is green, the application is up.
3. If the link still does not display, reinstall the application. Refer to the online help for information about reinstalling an application.
4. Contact HP technical support.

CD install



This section describes errors you might encounter when installing from a CD-ROM and the actions you should take to resolve the error.

The following error message might display when you are trying to install or update storage management applications from a CD-ROM:

Error message "<application name> install kit not found.
Check the label on the disk."

To resolve the problem:

1. Reinsert the CD into the CD-ROM drive. Wait for the CD-ROM to finish spinning.
2. Click *Install Products* under *Installation Service*.
3. Select the application to be installed.
4. Click the *Install* button located at the top left-hand corner of the content pane.
5. If the yellow LED on the CD-ROM drive stays on, it might indicate a bad drive. Contact HP technical support.

Network install

The following table describes error messages you might encounter when installing from the network and includes actions that you should take to resolve the error. If an application does not display in the navigation pane, reinstall the application. Refer to the online help for information about reinstalling an application. If the problem still persists, contact HP technical support.

| Error message | Action |
|---|--|
| "Cannot connect to the FTP site: <ftp site>" where <ftp site> is the name of the FTP site you are trying to connect to. | <ul style="list-style-type: none">■ Verify that the ftp server entered is correct and operational.■ Verify that the username and password entered are correct.■ Verify that the Storage Management Appliance can access the network where the ftp site resides. <p>If all of these conditions are correct, but the problem still persists, contact your system administrator.</p> |
| "Error when downloading the file <file path>" where <file path> is the path where the file being downloaded is located. | <ul style="list-style-type: none">■ Verify that the <file path> entered is correct. If incorrect, enter the correct file path.■ Verify that the <file path> entered is the absolute full file path. If incorrect, enter the full file path.■ Verify that the file name is included in the <file path> entered. If the file name is missing, enter the file name. <p>If all of the above are correct and the problem still persists, contact your system administrator.</p> |
| "Error in extracting the install kit <file name>" where <file name> is the name of the install kit file. | Verify that the file downloaded is a Storage Software installation kit. |
| "Cannot find Storage Software product in this file <file path>" where <file path> is the file path to the Storage Software product. | Verify that the file path entered in the <file path> is a Storage Software installation kit. |

Application status

To determine installed applications status, check the services list in Appliance Manager. To access the services list:

1. Under storage area network in the Storage Management Appliance software navigation pane, expand the applications folder.
2. Expand the configuration services folder.
3. Click *Appliance Manager*.
4. Click *Launch*.
5. Enter the user name and password.
6. From the navigation pane, select services list.

If you cannot locate the application, reinstall the application from the *Installation Services* option in the applications branch.

HP StorageWorks HSG Element Manager

HSG Element Manager displays information about the HSG controllers. This section describes troubleshooting information for the HSG controllers.



Note

For more information about troubleshooting HSG Element Manager, see online help, the HP OpenView Storage Management Appliance Release Notes, or the *Storage Software Management Appliance Configuration Guide*.

Subsystem not displaying or communication status failed

The subsystem does not display in the HSG Management System options table (under the options screen) after the initial SAN setup and discovery launch or the communication state has failed. To resolve the problem:

1. Refer to the *Storage Software Storage Management Appliance Configuration Guide* to ensure that your controller is properly configured for the Storage Management Appliance.
2. Ensure that CCL is enabled or that at least one LUN is presented to the Storage Management Appliance. If using a LUN, ensure that it is presented to the Storage Management Appliance through each controller's host port.
3. Ensure that the Storage Management Appliance has at least one online connection. Check the controller connections table by entering the CLI command `SHOW CONNECTIONS`. This step will show the online or offline status for each controller's host port connection.
4. If no error is indicated the setup or connections, disconnect the Fibre Channel cable from the Storage Management Appliance. This step isolates the Storage Management Appliance from the switch.
5. Reconnect the Fibre Channel cable to the Storage Management Appliance. This step re-establishes connection between the Storage Management Appliance host bus adapters and storage controllers.
6. If the problem still persists, contact HP technical support.



Note

Rebooting the Storage Management Appliance is not recommended to resolve the subsystem communication state.

Subsystem data

If any of the subsystem data does not display current data for a specific subsystem, check the communications state.

If the communications state is *Failed*, refer to the subsystem not displaying or communication state failed section. If the communications state is *Good*, refresh the subsystem data:

1. From the HSG Element Manager home page, select the subsystem under HSG network in the navigation pane.
2. Click the refresh button at the top of the content pane.

Unable to communicate with subsystem

The following states indicate a communication failure with the subsystem:

- CLI commands fail with communication errors.
- Refresh time-outs or unable to refresh subsystem.
- Time-outs when attempting to modify subsystem configuration (for example, by modifying or creating a virtual disk).

To resolve this problem, check the communications state. Access the subsystem properties page from the HSG Element Manager home page. Select the subsystem under HSG Network in the navigation pane.

If the communications state is *Failed*, refer to the communication state failed section. If the communications state is *Good*, refresh the subsystem data:

1. Attempt the operation again. Occasional time-outs are normal when operations are attempted while HSG Element Manager operations are in progress.



Note

Ensure that you are running ACS firmware version 8.5 or higher.

2. If CCL is disabled, ensure that a communication LUN is presented to the Storage Management Appliance through each controller's host port (there are two host ports per controller). Refer to the *Storage Software Storage Management Appliance Configuration Guide* for more information about CCL and LUNs.
3. If a Run Command session is open, wait for it to be closed. If a Run Command session was closed incorrectly (without clicking the *Close* button), click the *Unlock* button to recover. The *Unlock* button is located at the top of the content pane in the CLI window in HSG Element Manager.



Note

Clicking the *Unlock* button invalidates any Run session in progress. Incorrect use of the *Unlock* button can result in the CLI returning undefined data.

4. If a Command Scripter script was running that used the `LOCK` command, wait for the script to issue an `UNLOCK` command. If the script terminated without issuing an `UNLOCK` command, click the *Unlock* button to recover. The *Unlock* button is located at the top of the content pane in the CLI window in HSG Element Manager.



Note

Clicking the *Unlock* button invalidates any lock held by a Command Scripter script. Incorrect usage of the *Unlock* button can result in the CLI returning undefined data.

Appliance Manager

This section provides information about troubleshooting Appliance Manager.

Returned to Appliance Manager home page

If you select an Appliance Manager option (for example, change password) and the Appliance Manager home page is displayed, proceed with the Appliance Manager selection.

Renaming the Storage Management Appliance

Change the Storage Management Appliance name using only the Appliance Manager name change utility. If you change the name by any other method, the name change will compromise the operation of the Storage Management Appliance and applications.



Warning

Do not change the name of the Storage Management Appliance unless absolutely necessary. Changing the name takes from 5 to 20 minutes to complete and will restart the Storage Management Appliance more than once.

HP SANworks Allocation Reporter

This section provides information about troubleshooting Allocation Reporter.

LUNs not found

If LUNs are not found during a scan, check the following:

1. Ensure that CCL is enabled or that at least one LUN is presented to the Storage Management Appliance. If using a LUN, ensure that it is presented to the Storage Management Appliance through each controller's host port.
2. Ensure that the Storage Management Appliance has at least one online connection. Check the controller connections table by entering the CLI command `SHOW CONNECTIONS`. This step will show the online or offline status for each controller's host port connection.

Data is old, incorrect, or missing

If the data in a report is out of date, incorrect, or missing, check the following:

1. If you made changes to your storage resources, ensure that a scan occurred *after* the changes were made. Changes to Allocation Reporter resources do not display until they are scanned.
2. Consult the alert window for messages related to Allocation Reporter. Take corrective action based on the messages.
3. Ensure that reports have completed loading.

If you select a single customer usage, single storage subsystem, or single customer billing report from a report in which the data has not completed loading, the single-component report might be incomplete. You must wait for the original report to stop loading before selecting a single-component report.

Storage Management Appliance migration procedures

This section describes the supported migration configurations for storage environments that include Enterprise Virtual Array controller pairs and HSG Fibre Channel Array controller pairs managed by separate instances of the Storage Management Appliance.

With the release of Storage Management Appliance software version 1.0C (Storage Management Appliance update January 2002), storage environments that include the Enterprise Virtual Array (managed from an Enterprise Storage Management Appliance) and HSG Fibre Channel Array controllers (managed from an HSG Storage Management Appliance) can migrate to a single Storage Management Appliance.

Migration from separate Storage Management Appliances to a single Storage Management Appliance is an optional procedure. HP recommends assessing individual storage environment requirements before implementing the migration procedure.



Note

Storage Management Appliance update January 2002 is required to accomplish the migration.

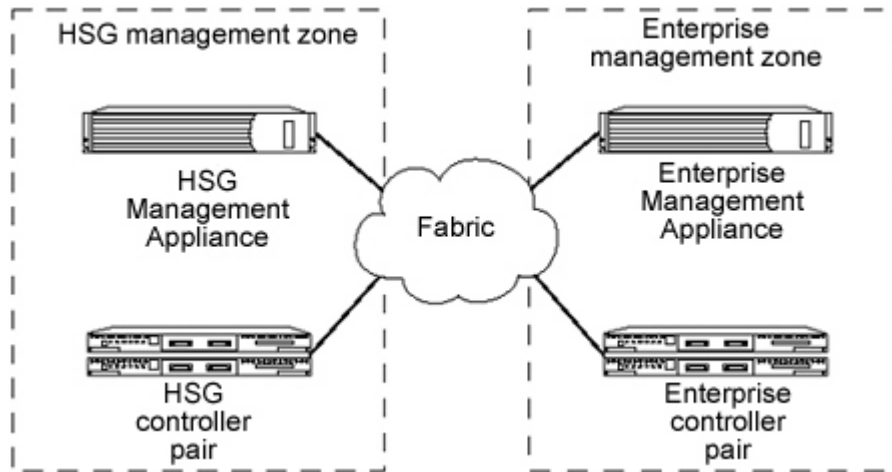
Supported Storage Management Appliance migration paths

The following migration paths are addressed in this section:

- **Preferred migration path** — The HSG Storage Management Appliance is “migrated” to the enterprise storage environment by changing the management zone membership. Migrating a Storage Management Appliance means configuring your SAN for a single Storage Management Appliance to manage both Enterprise controller pairs and HSG controller pairs. This is the recommended migration path.
- **Alternate migration path** — The following options are available to accomplish the alternate migration path:
 - **Option A** — Migrating the Enterprise controller pairs to the HSG management zone
 - **Option B** — Adding all devices (HSG controller pairs, enterprise controller pairs, and migrated Storage Management Appliance) to a newly created migrated management zone.

For both the preferred and alternate migration paths, migration is a functional, not a physical, process. In all cases, select the migration path that is appropriate for the respective storage environment requirements.

Configuration before migration



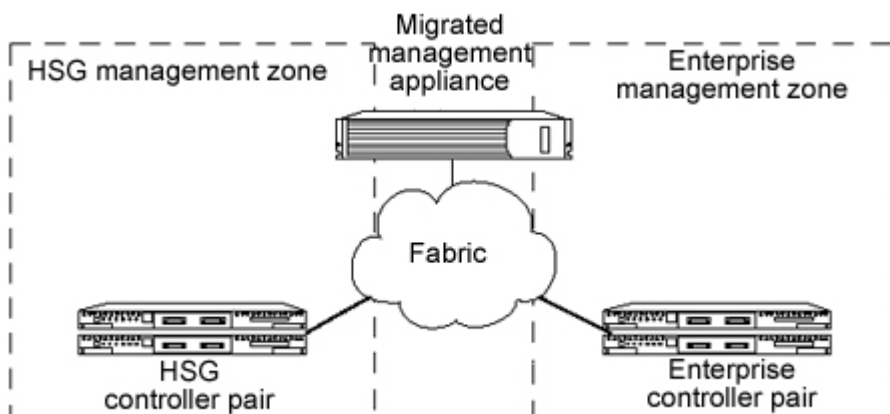
The preceding diagram shows the enterprise HSG storage environment before the migration procedure. The environment consists of the HSG management zone and enterprise management zone.

In separate enterprise and HSG storage environments, the enterprise Storage Management Appliance and HSG Storage Management Appliance are members of separate zones. These management zones include the Storage Management Appliance (HSG or Enterprise) and its associated storage controller pairs.

Fabric zones can be:

- **Hard zoned** — By physical switch port
- **Soft zoned** — By switch worldwide identification (WWID)

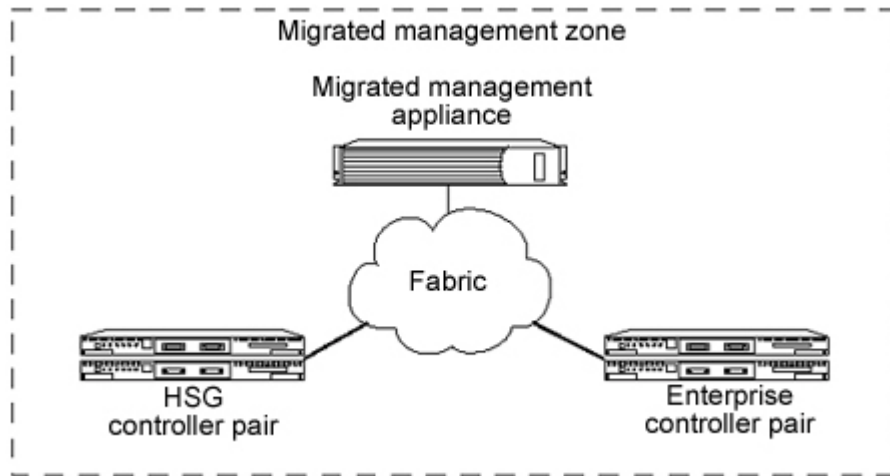
Preferred migration path



The preceding diagram shows the recommended migration path where the HSG Storage Management Appliance is migrated to the enterprise management zone. After this migration procedure is completed, the migrated Storage Management Appliance manages both the HSG and enterprise controller pairs.

In the preferred migration path procedure, migration can be accomplished by changing the zone membership (HSG controller moves to the enterprise management zone). However, this change does not alter the existing management zone.

Alternate migration path



The preceding diagram shows the alternate migration path, which is accomplished through one of the following options:

- **Option A** — Migrating the enterprise controller pairs to the HSG management zone.
- **Option B** — Adding all devices (HSG controller pairs, enterprise controller pairs, and migrated Storage Management Appliance) to a newly created management zone (migrated management zone)

In the alternate migration path procedure, migration is accomplished by changing the zone membership through the following options:

- **Option A** — Adding enterprise controller WWNs to the existing HSG management zone
- **Option B** — Adding device WWNs for HSG controller pairs, enterprise controller pairs, and the migrated Storage Management Appliance to a newly created zone

Learning check

1. What tools are available when troubleshooting problems with the Storage Management Appliance?
.....
.....
.....
2. Which one of the following is the first indicator that a device might not be communicating on the Ethernet?
 - a. No indicator lights on the Ethernet adapter or interface of the device.
 - b. Fibre Channel switch does not see the device.
 - c. Fibre Channel cable disconnected.
 - d. Device shows indicator lights but cannot be pinged by name.
3. What are some possible reasons that the Storage Management Appliance is no longer receiving SNMP traps?
.....
.....
.....
4. What port is used to connect to the Storage Management Appliance through a web browser?
.....
.....
.....

HP OpenView Storage Provisioner — Concepts, Installation and Operation

Module 4

Objectives

After completing this module, you should be able to:

- List the features of HP OpenView Storage Provisioner.
- Define the concept of provisioning storage.
- Name the two main participants in the process of provisioning storage and list what they manage.
- List the steps to create a Storage Provisioner environment.
- Identify and describe the reports viewed from the reporting tab.
- Identify the tasks that can be performed using the Admin tab.
- Identify the information that Storage Provisioner provides that can help you resolve problems.

Overview

Storage Provisioner enables storage providers to manage storage utilities, customize service levels, and allow customers access to each utility. For storage consumers, Storage Provisioner enables self-service allocation of new storage, within the bounds of their existing service level agreements. It also allows direct control of host access to volumes, without requiring provider intervention. Reporting features provide usage and billing reports for both providers and consumers. Additionally, storage providers and consumers can export configuration data, providing a backup of the provisioned environment.



Storage Provisioner resides on the HP OpenView Storage Management Appliance and is provided as a Storage Management Appliance application. Storage Provisioner manages HP StorageWorks HSV array controllers and HSG80 controllers.

Provisioning storage

Provisioning storage is the process that allocates storage resources based on storage needs. Storage Provisioner takes this concept further by providing a graphical user interface (GUI) that creates a provisioning environment, defines customer and service levels, and manages storage allocations to meet customer needs. Within the application, the need no longer exists to manually set up LUNs or manually keep track of customer storage use.

The process of provisioning storage involves two main participants:

- **Storage providers** focus on the management of storage systems and SANs.
- **Storage consumers** focus on management of their hosts and applications.

Storage providers manage:

- **Utilities** — A set of storage systems.
- **Service levels** — Storage attributes that define the level of requirements for all storage systems within the service level.
- **Storage systems** — HSG-based storage systems and HSV-based storage systems.
- **Customers** — The owners of hosts and applications on the hosts, and the users who pay storage providers for storage used.
- **Quotas** — The limits placed on customer storage use, and connectivity, in a utility.

Storage consumers manage:

- **Hosts** — Application servers that use storage presented by the storage systems.
- **Paths** — The defined connection, from one host to one utility, specifying the set of host bus adapters (HBAs) that make the connection.
- **Volumes** — The collection of raw storage blocks in a storage system that contain data.

Features

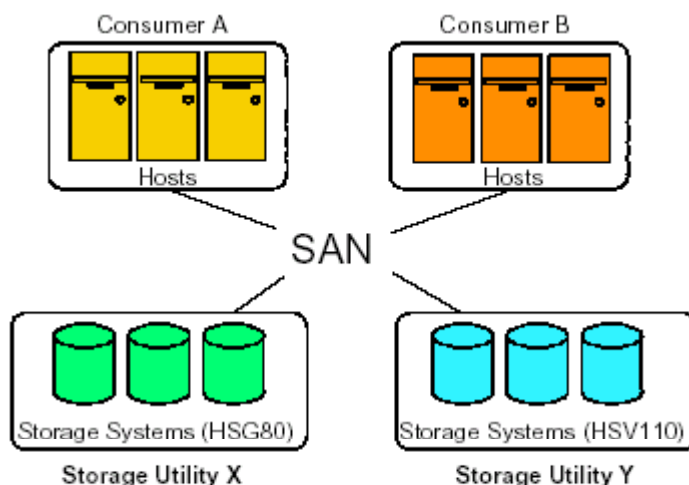
Storage Provisioner for storage providers enables you to:

- Manage storage systems, storage utilities, and service levels.
- Create, modify, and delete consumer accounts and groups, along with service levels and storage utilities.
- Discover storage systems.
- Display customer quotas and storage utility access information.
- View customer storage history information and current usage information for volumes and connections.
- Export and save storage usage and volume report information.
- Save configuration data to a file and restore that data back to Storage Provisioner.

Storage Provisioner for storage consumers enables you to:

- Create, modify, and delete hosts, paths, and volumes.
- Access volumes.
- View storage and host summary information.
- View storage history and current usage information for volumes and connections.
- Export, save, and print storage usage and volume report information.

Provisioning Framework



The Storage Provisioner environment consists of a storage area network (SAN) that includes: host systems, storage systems, controllers, a network, a Storage Management Appliance, and storage software.

In addition to the Storage Provisioner software, a complete provisioning solution includes the elements in the following table.

| Product | Description |
|--|--|
| Storage Management Appliance and Storage Management Appliance Software | Centralized storage management architecture and application services |
| Notification Utility | Provides event management services, including logging, email, pager, and SNMP trap services. |
| Nexus | Modular, Java environment that <ul style="list-style-type: none"> ■ provides storage system configuration services ■ ensures groups of storage system configuration requests are completely successful, or not applied at all ■ uses existing element managers to discover and manage storage systems ■ reduces load on the storage system controllers for most storage management actions ■ shared by several storage management applications. |
| MA/RA8000, EMA/ESA12000, and EMA16000 arrays | HSG80-based storage systems |

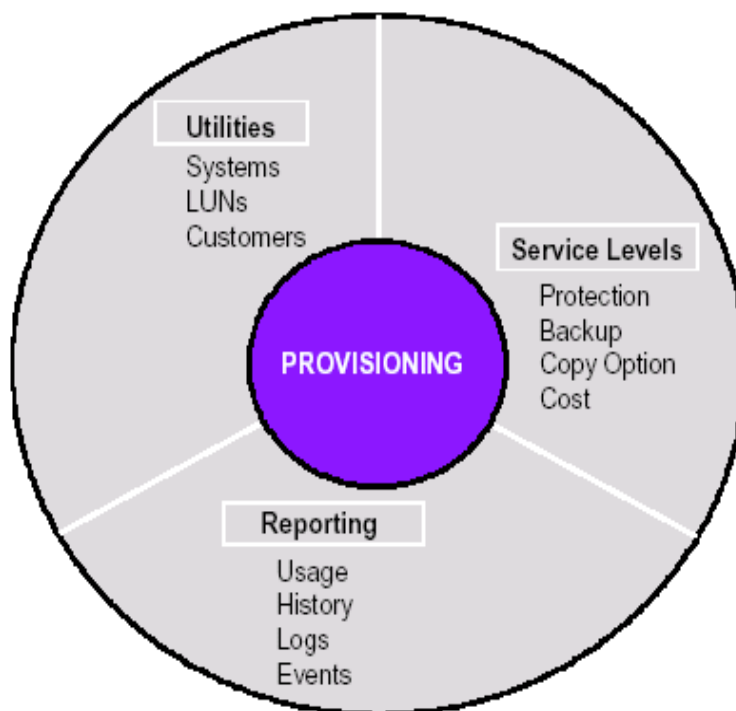
| Product | Description |
|---|--|
| HSG80 Element Manager | Provides discovery and management of HSG80-based storage systems. |
| Command View EVA | Provides discovery and management of HSV-based storage systems. |
| Enterprise Virtual Array 3000 or 5000 | HSV-based storage systems |
| Host configurations supported by the storage systems | Application servers that use storage presented by the storage systems |
| Fabric and network components supported by the Storage Management Appliance and storage systems | Provides fibre connectivity between the appliance, hosts, and storage systems; provides TCP/IP network connections for management. |

Storage Provisioner discovers existing storage systems already configured as a part of a SAN. After being discovered, these storage systems display in an *unmanaged systems group* and can be moved to utilities for management by Storage Provisioner. Additionally, if changes are made to the SAN outside of Storage Provisioner, those changes are acknowledged in Storage Provisioner by using the Discover task within Storage Provisioner.

Areas of provisioning

Storage Provisioner divides provisioning into three areas:

- Storage utilities
- Service levels
- Reporting



Storage utilities

Storage utilities provide the framework for provisioning storage requirements. A storage utility is a set of storage systems managed by the storage provider. It is the basis for granting access to storage utilities. The storage provider manages the storage system, and the storage customer manages the hosts and applications that need storage.

Service levels

Service levels allow storage providers to define the storage attributes that give consumers access to available storage in utilities. Service levels also define the cost for storage use. You define service levels when setting up customers to access storage systems and volumes. The service level name and description are the only two attributes visible to the storage customer.

When you create a service level, you specify storage attributes that define the level of requirements for all storage systems within that service level. These attributes include the type of storage system, protection level, copy option, backup option, and price per gigabyte. The attributes are applied when Storage Provisioner creates volumes.

Storage Provisioner does not configure any backup applications. The copy and backup options document the configuration you completed outside of Storage Provisioner after the storage consumer creates volumes. These options also enable Storage Provisioner to reserve storage for making snapshots or clones. By reserving the storage for these options, you reduce the storage size available during the provisioning process, ensuring that Storage Provisioner does not allocate more storage than required.

Example

You may have several different customers that have different storage requirements. One customer may have a very large environment that includes applications requiring a large amount of storage within a high-availability environment.

The service level defined for this customer may include the following:

- HSV110 storage system
- VRAID 5 protection level
- Instantaneous snapshot copy option
- \$15-per-gigabyte

A different customer may only need VRAID 1 protection level with backup option.

Reporting

Reporting tools allow the storage provider and storage consumer to review storage use, quotas, and billing history. Storage Provisioner also provides administrative tools that display generated logs and events. These tools help the storage provider diagnose problems that occur.

Installing and launching Storage Provisioner

Before installing Storage Provisioner, confirm that the system and software requirements have been met.

System requirements

- Storage Management Appliance
 - HSV-based controller on EVA 3000/5000
- OR
- HSG-based controller on MA/RA/ESA/EMA

Software requirements

Note

Refer to the HP QuickSpec and Installation Instructions for the latest supported versions.

- Appropriate update to the Storage Management Appliance Software
 - Browsers supported by the Storage Management Appliance
 - JAVA plug-in
 - Appropriate version of Command View EVA for HSV controllers
- OR
- Appropriate version of Element Manager for HSG controllers

Installation process

The Storage Provisioner installation process includes:

- Fulfilling the pre-installation requirements.
- Using the device manager to modify local host setup, host name and passwords.
- Installing the Storage Provisioner software.
- Adding permissions to the *java.policy* file on the local computer accessing the Storage Management Appliance to allow for backing up the database and exporting provisioning data.

Complete the following steps:

- a. On the hard drive of each computer used to browse to the SMA, locate your *java.policy* file by using the search or find function.
- b. Open the file.
- c. Find the following *grant* line at the top of the file:

```
grant {permission java.security.AllPermission;;}
```
- d. Edit the *grant* file of the *java.policy* file to look like this:

```
grant {permission java.security.AllPermission;;//Standard extensions  
get all permissions by default grant codeBase  
"file:${java.home}/lib/ext/*"}{permission  
java.security.AllPermission;;//default permissions granted to all  
domains
```
- e. Save the modified *java.policy* file.

Launching Storage Provisioner

Storage Providers launch Storage Provisioner from the Storage Management Appliance. After the storage provider defines storage allocations, service levels, and customers, the storage consumer can launch Storage Provisioner for Storage Consumers through a designated URL and port number that the Storage Providers supply.

Storage provider launch procedure

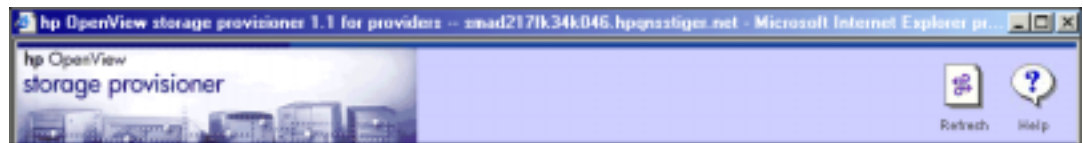
1. Browse to the Storage Management Appliance from a web-enabled workstation
2. Select *Tools* → *Storage Provisioner* to access Storage Provisioner.



About the User Interface

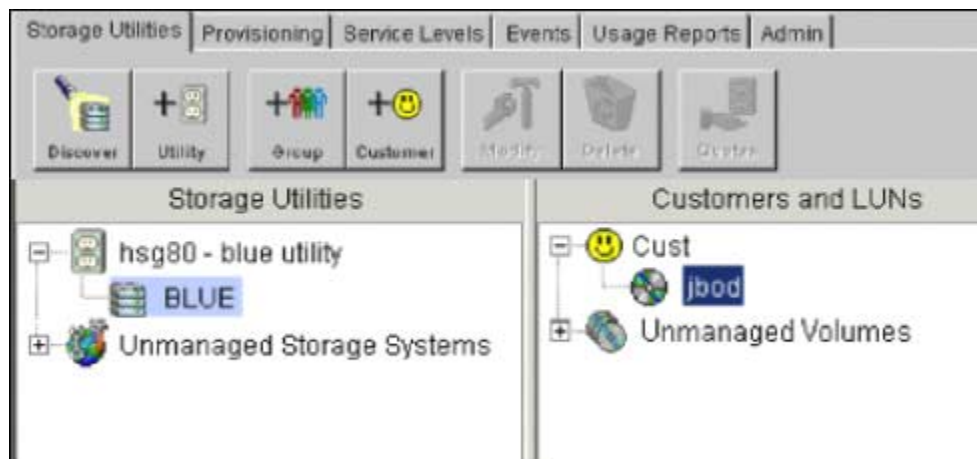
The Storage Provisioner user interface consists of a tri-pane window containing the following:

- **Session pane** — Includes links that you can select to perform functions such as:



- **Refresh** — Updates Storage Provisioner with changes made by other users. A refresh of the provisioning display automatically occurs when you select a new tab or when a create, modify, or delete operation occurs.
- **Help** — Displays general online help in a separate browser.

- **Navigation pane** — Displays links to where you view information about your storage utilities, customers, and service levels. Storage Provisioner provides two views:
 - Storage Utilities
 - Customers and LUNs



The two navigation panes contain trees that share relationships between the items in the trees. Storage Provisioner highlights these relationships visually so you can see how one component fits into the SAN from two viewpoints, the provider and consumer views.

When you click a link, information about the selected resource displays in the Content pane. Also, the actions available to you on the toolbar change depending on your selection in the Navigation pane.

- **Content pane** — Displays information about the item that you selected in the Navigation pane.

| 8.7P G80 Details | |
|---------------------------|----------|
| Name | Value |
| Controller Type | HSG80 |
| Storage Systems | 1 |
| Physical Storage: | |
| Total | 72 GB |
| Unused | 0 GB |
| Usable Storage: | |
| (No Service Levels) | |
| Reserved For Copy | 0 GB |
| Failover Mode | Multibus |
| SCSI Mode | SCSI-3 |
| Paths Available | 0 |
| Paths Allocated | 8 |
| Paths Used | 0 |
| Operating Systems Allowed | Tru64 |
| | OpenVMS |
| | HPUX |
| | Linux |

When you select an item in the Navigation pane, related information displays in the Content pane. For example, the preceding screen displays when you click the storage utility called *hsg80 - blue utility* in the Navigation pane. The summary for the selected storage utility displays in the Content pane.

Creating the provisioning environment

The steps in creating a provisioning environment are:

- Discover storage systems
- Create utilities
- Assign storage systems to utilities
- Create customer groups and customers

Discovering storage systems

With Storage Provisioner, you can discover and manage HSV-based or HSG-based storage systems to meet your customer's storage requirements. Storage systems are assigned to utilities for management by Storage Provisioner. Unmanaged storage systems are those storage systems that are a part of a SAN, but are not currently managed by Storage Provisioner.

When launched, Storage Provisioner opens in a new browser window with the Storage Utilities tab active.



To discover storage systems:

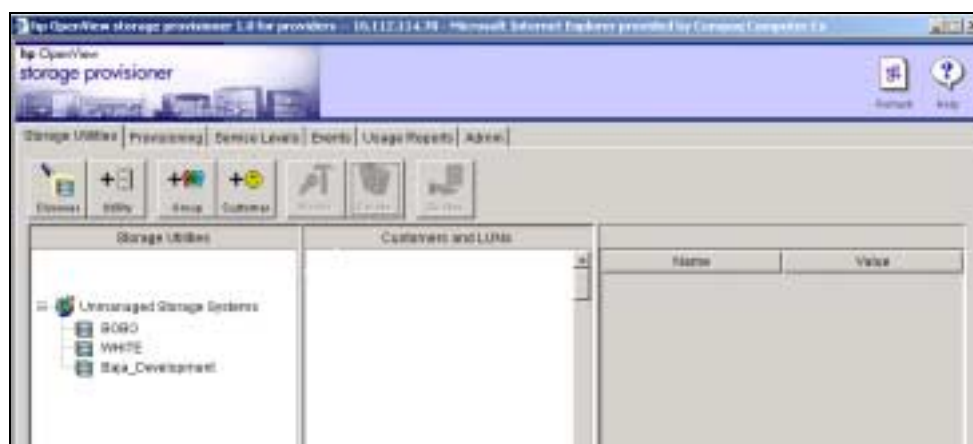
1. Click the *Discover* button.

If this is the first time using or setting up Storage Provisioner, your storage systems display in the Utilities pane under *Unmanaged Systems*. A message displays the number of storage systems found in the SAN.

If your Storage Provisioner is already set up, then select a storage system displayed in the Navigation pane. You can then modify or delete the selected storage system.

2. Click *OK*. The newly discovered storage systems display in the *Unmanaged Storage Systems* group in the Navigation pane.

Now you can create utilities to move the storage systems for management by Storage Provisioner.



Creating utilities

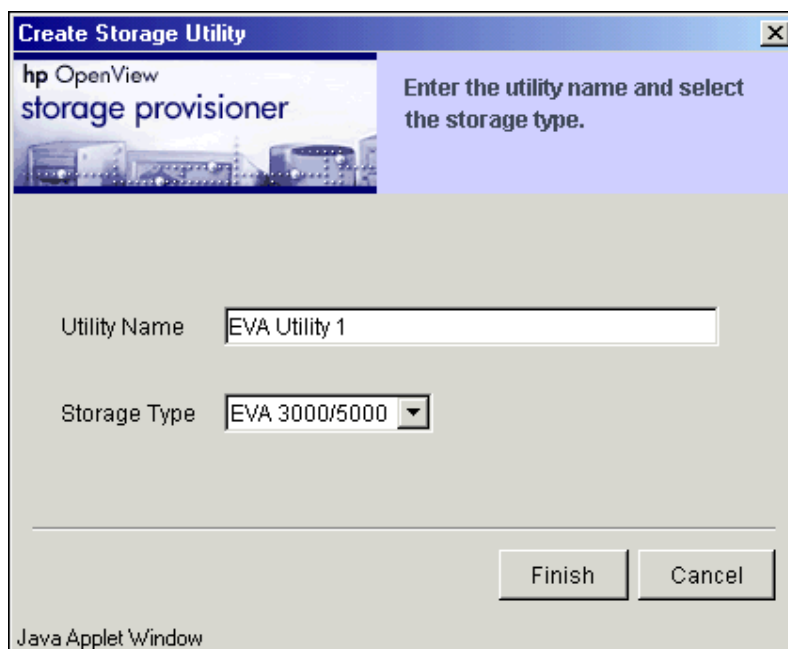
Storage Provisioner manages storage systems by grouping them into storage utilities that share the same characteristics. Using the Storage Utilities tab, you can define and manage your storage and customer information by:

- Defining utilities
- Discovering and managing storage systems
- Defining customer groups and customers
- Managing customer volumes
- Assigning quotas and granting access to volumes

To create a utility:

1. Select the *Storage Utilities* tab
2. Click the *Utility* button on the toolbar

A separate dialog window displays to lead you through the process of creating a storage utility.



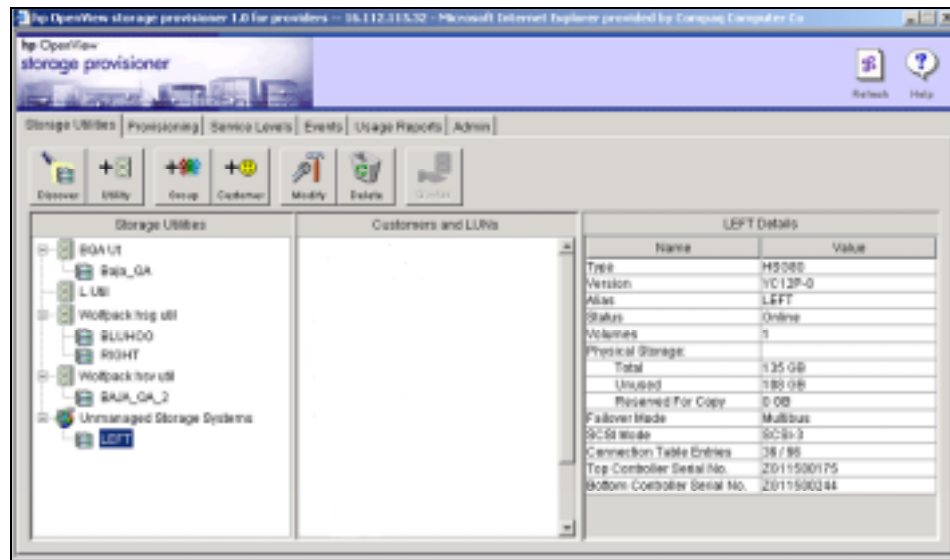
The image shows a Java Applet Window titled "Create Storage Utility". The window has a blue header bar with the HP OpenView logo and the text "storage provisioner". Below the header, there is a light blue area with the instruction "Enter the utility name and select the storage type." The main area of the window is light gray and contains two input fields: "Utility Name" with the text "EVA Utility 1" and "Storage Type" with a dropdown menu showing "EVA 3000/5000". At the bottom right, there are two buttons: "Finish" and "Cancel". The text "Java Applet Window" is visible at the bottom left of the window.

3. Enter a utility name and select the storage type from the pull-down list.
 - The storage utility name must be unique.
 - Storage Provisioner does not manage storage systems configured in HSG80 transparent mode. An error message displays if you attempt to add a storage system configured in transparent mode.
 4. Click *Finish* at the bottom of the window.
- After you click *Finish*, the new utility displays in the Navigation Pane.

Assigning storage systems to a utility

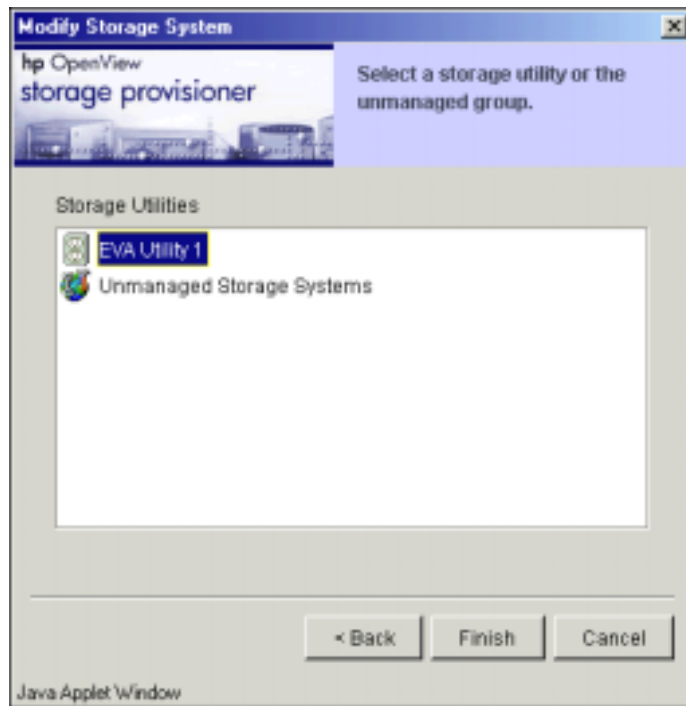
To assign a storage system, the storage system must first be modified. To modify a storage system:

1. Select the *Storage Utilities* tab.



2. Select a storage system listed in the Navigation pane. Your selection is highlighted.
3. Click *Modify* on the toolbar. A Modify Storage System dialog box displays with the name of the Storage System. Click *Next*.

4. Another Modify Storage System dialog box displays showing existing utilities and an Unmanaged Storage Systems item.



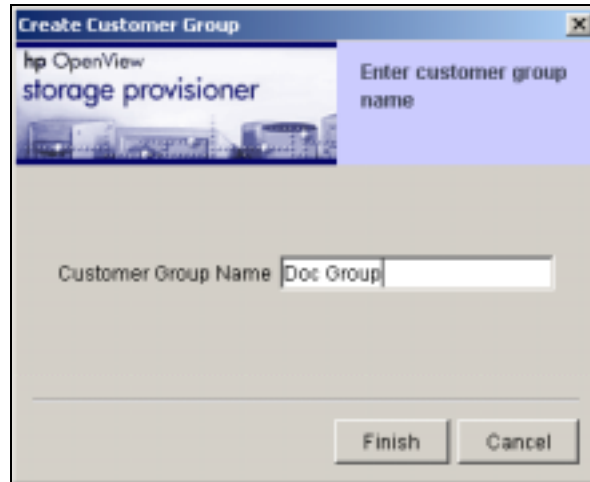
5. Select a storage utility or the *Unmanaged Storage Systems* item.
 - Storage systems with assigned volumes cannot be moved to a different utility.
 - If *Unmanaged Storage Systems* is selected, Storage Provisioner no longer manages the system.
6. Click *Finish* to complete the modifications, or *Cancel* to stop. Clicking *Finish* displays the modifications in the Navigation pane.

Creating customer groups

With Storage Provisioner, you manage your customers by assembling customers with similar characteristics into groups. For example, you may want to define one group to represent all accounting customers.

To create a customer group:

1. Select the *Storage Utilities* tab.
2. Click *Group* on the toolbar. The Create Customer Group dialog box displays.



3. Enter the customer group name in the text field and click *Finish*. The new customer group displays on the Navigation pane.

Creating customers

With Storage Provisioner, you can manage your customer information and storage requirements, and grant access to that storage. When you set up your customers, you assign each customer a username and password. Customers use this username and password to access Storage Provisioner for Storage Consumers.

To create a customer:

1. Select the *Storage Utilities* tab.
2. Click *Customer* on the toolbar. The Create Customer dialog box displays.



The 'Create Customer' dialog box is shown. It has a title bar with 'Create Customer' and a close button. The main area has a header with the HP OpenView storage provisioner logo and a tip: 'Enter the customer name and login account.' Below this are three text input fields: 'Customer Name' (containing 'Dsc TeamA'), 'Login Username' (containing 'jsama'), and 'Login Password' (containing 'jsama'). At the bottom right are 'Next >' and 'Cancel' buttons.

3. Enter the customer information and click Next.



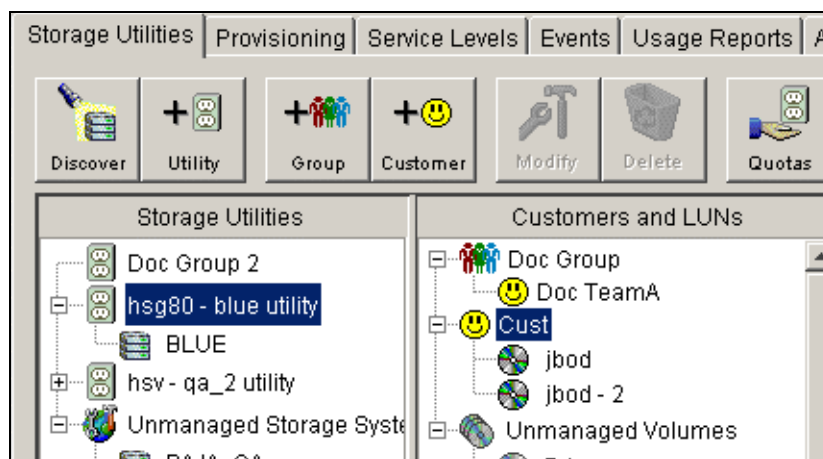
The 'Create Customer' dialog box is shown in its second step. The header has a tip: 'Select a customer group. Use ctrl-click to turn off a selection.' Below this is a section titled 'Existing Customer Groups' which contains a list box with one item: 'Dsc Group' (indicated by a small icon). At the bottom are '< Back', 'Finish', and 'Cancel' buttons.

4. Select a customer group from the list of customer groups (optional).
5. Click *Finish*. The newly created customer displays in the Customers and LUNs column of the Navigation pane.

Quotas

Storage Provisioner allows you to set and view quotas and grant access (storage allocations) for your customer. Quotas specify the amount of storage the customer can use in the utility. You can also grant or deny a customer access to a storage utility. Using the Storage Utilities tab, you can:

- **View and set quotas** — Displays information about your customer's storage requirements and set the availability of the storage.
- **Grant and deny access** — Allows you to allocate storage access for your customers, or deny access.



To view quotas or grant access:

1. Select the *Storage Utilities* tab.
2. Hold down the *Shift* key and select **both** a storage utility and a customer.
The selected items are highlighted.
3. Click *Quotas* on the toolbar.

A window displays that steps you through the process to grant the customer access to the storage utility.

4. Select one of the options.
 - a. **Deny access** — Denies the customer access to the storage utility and disables host access to any existing volume in that utility. All customer volumes must be removed before access can be denied.
 - b. **Set quota to** — Specifies the amount of storage (in gigabytes) to allow the customer to use in the utility. It is the amount of usable storage, not physical storage. Storage Provisioner allows you to allocate more storage than is physically available in the utility. You can use this to help allocate for budgets and add storage as necessary.
5. Enter the Quota amount.
6. Click *Next* to move to the next window display or *Cancel* to stop the task.

The Number of Host Paths window displays.



The image shows a Java Applet Window titled "Storage Utility Access". The window has a blue header bar with the HP OpenView Storage Provisioner logo on the left and a text box on the right that says "Enter the number of hosts and volumes allowed in the storage utility." Below the header, the main area is light gray. It contains the following text: "For storage customer ☹ Doc TeamA", "in storage utility 🗄 EVA Utility 1", "Allocate hosts (256 available)", "Allocate volumes (512 available)", and "Message For Customer" followed by a text input field. At the bottom right, there are three buttons: "< Back", "Finish", and "Cancel". The bottom left corner of the window says "Java Applet Window".

7. Specify the number of hosts and volumes (HSV110 only) or allocated paths (HSG80 only), and enter a message to the customer.

Note

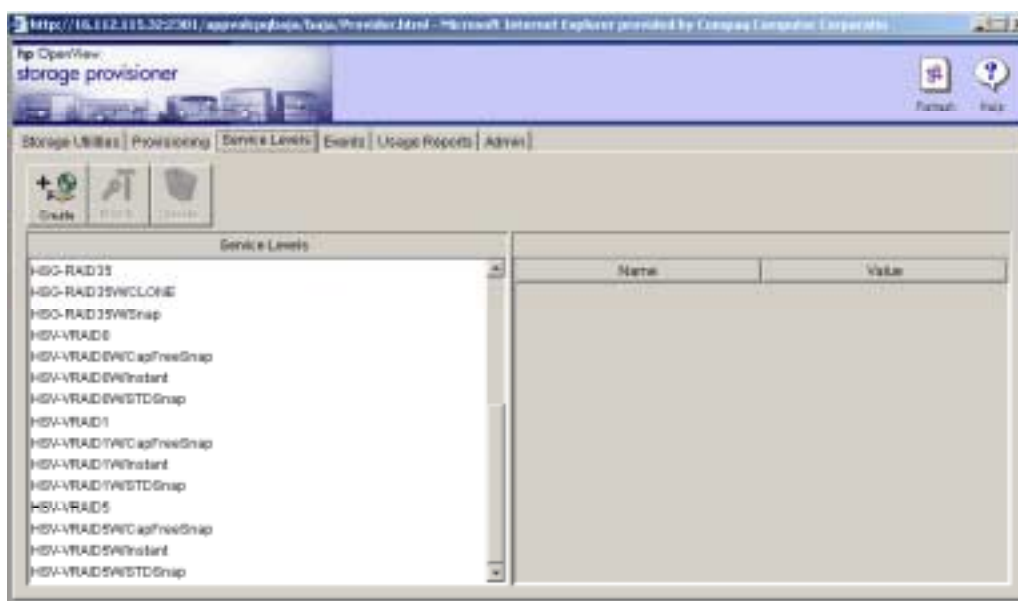
In HSV-based utilities, the quota limits the number of hosts a customer can connect to the utility. In HSG-based utilities, the quota limits the number of paths a customer can use to connect hosts to the utility.

To allocate paths for HSG80 storage systems, the number of paths should not exceed the number of unallocated paths for the utility, and must not be less than the number of paths used by the customer in that utility. Storage Provisioner allows you to over-allocate paths (a warning message displays).

- Click *Finish* to complete the action and grant the customer access to the storage utility, or *Cancel* to stop the action.

Service levels

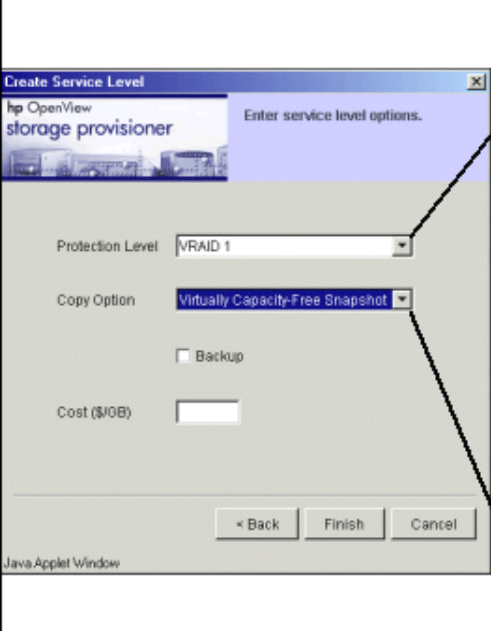
Service levels provide a way to name a group of storage attributes. The storage provider defines service levels with the appropriate storage attributes.



b

The Service Levels tab enables you to view, create, modify, and delete service levels. When you make a selection, a separate window displays to step you through the process.

The storage consumer can select from the service levels to match the level of storage allocations needed by setting the Protection Level and Copy Option.

| | |
|---|--|
|  | HSV storage: VRAID 0, VRAID 1, VRAID 5 |
| | HSG80 storage: JBOD, RAID 0, RAID 1, RAID 3/5, RAID 0+1 |
| | HSV storage: None Standard Snapshot, Virtually Capacity-Free Snapshot Instantaneous Snapclone |
| | HSG80 storage: None, Clone, Snapshot |

The service level can also flag the volumes to be assigned for backup and define the cost for storage usage.

When the service level has assigned volumes, you cannot modify Protection Level and Copy Option so ensure they are set appropriately when creating the service level.

Provisioning

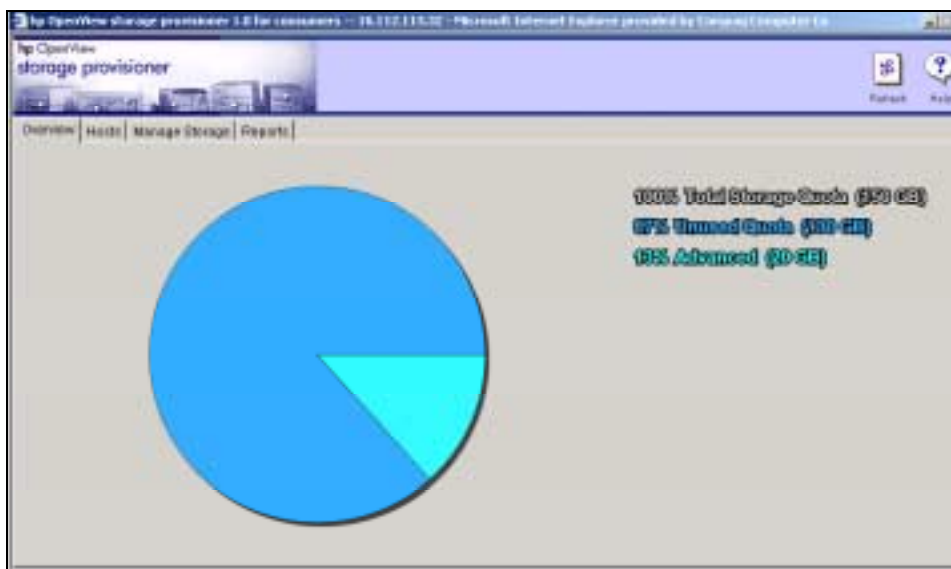
Storage Provisioner provides a complete storage management solution for storage providers and storage consumers. The Provisioning tab allows storage providers to view the storage customers' environment, to allocate new storage, and to control host access. After selecting the Provisioning tab, a customized set of toolbar buttons displays to manage the storage.

Now that the storage provider has defined storage allocations, service levels, and customers, the storage can be provisioned. The storage providers or the storage consumers can complete the same provisioning tasks. The providers use the *Provisioning* tab. The storage consumer launches Storage Provisioner for Storage Consumers through a designated URL.

Storage consumer launch procedure

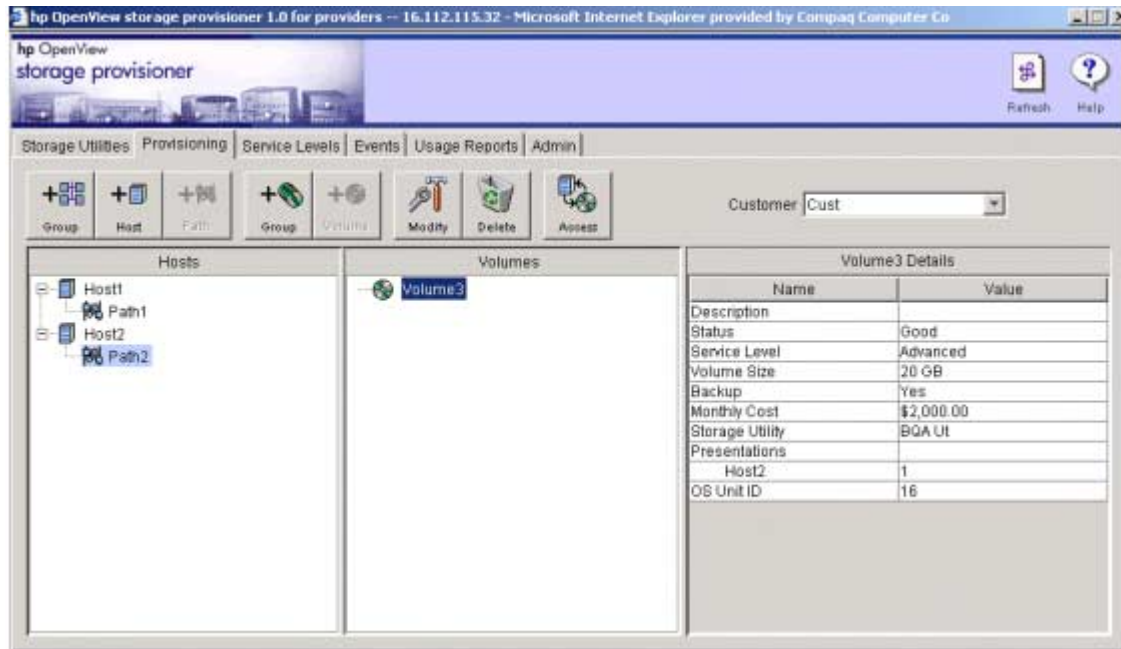
Storage consumers launch Storage Provisioner for Consumers using the following procedure:

1. Open a web browser and enter `x.x.x.x:7777`
where:
`x.x.x.x` is the IP address of the Storage Management Appliance
`7777` is the designated port number
2. The Storage Provisioner for Storage Consumers launch page displays. Click *storage provisioner* to launch the tool.
3. In the new browser window, enter username and password, then click *Login*.
4. Storage Provisioner for Consumers opens displaying the customer's current total storage quota and unused quota in a graphical representation.

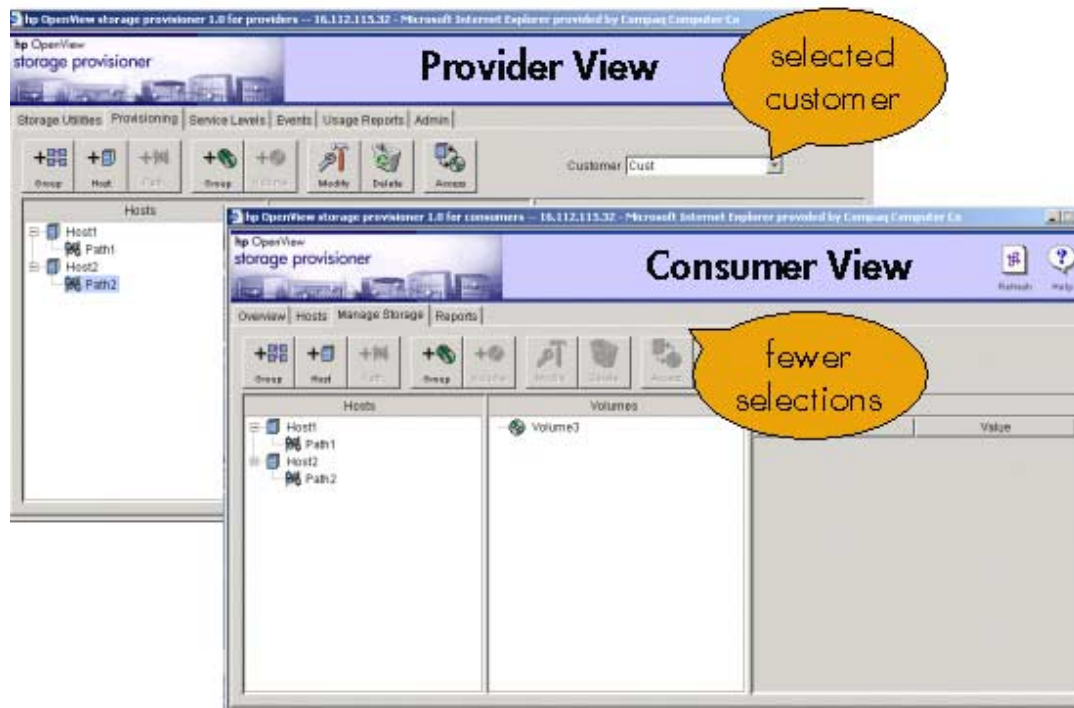


Viewing a customer's environment

To help you understand your customer needs, Storage Provisioner provides access to your customers' provisioning environment. Select the *Provisioning* tab and select a customer from the drop-down list. The customer's provisioning environment displays in the Navigation panes.



A storage consumer has basically the same view as a storage provider, but can only see what they are authorized to see (instead of all customers) and have fewer options available on the toolbar.



Host Groups and Hosts

A customer's first step in provisioning storage is to create hosts groups and hosts.

Host Groups

Host groups are optional but are a convenient way to manage hosts. That is, you may want to group host systems that are all in one location, or that are a part of a system such as Accounting.

With the host group button, you can:

- View existing host group information.
- Create host groups.
- Modify host group information.

To create a host group, select *Group* and enter a name.

Hosts

With Storage Provisioner, you can manage the hosts that are part of your storage environment.

With the Host button, you can:

- View existing host information.
- Create hosts.
- Modify host information.
- Delete hosts.

To create a host, select *Host* from the *Provisioning* Tab and follow the wizard and enter a name and select the appropriate operating system.

Paths

A path defines a connection from a host to a storage utility. Using Storage Provisioner, you can create paths to connect your selected host system to a storage utility. This connection enables the customer to provision storage from the utility, and allows the host to see volumes in the storage utility.

The following information provides an overview of paths:

- A path specifies a port of a HBA that connects a host to a storage system. Before defining paths, ensure that each specified HBA is zoned to allow each HBA to see all controllers in the storage utility.
- To connect a host to multiple storage utilities, you must define a different path from the host to each utility. These paths may specify the same HBA ports.
- Different hosts cannot have paths that specify the same HBA ports.
- Both single-fabric and dual-fabric configurations are supported.
- Paths to HSG80 storage utilities have the following additional characteristics:
 - A host can connect to an HSG80 storage utility with one or more paths, with each path specifying two HBAs (a pair in a multibus configuration).
 - Different paths from the same host to the same storage utility must contain different HBAs.

- Paths to HSV storage utilities have the following additional characteristics:
 - A host can connect to an HSV storage utility with only one path.
 - All HBA ports connected to the storage utility are specified in that path.

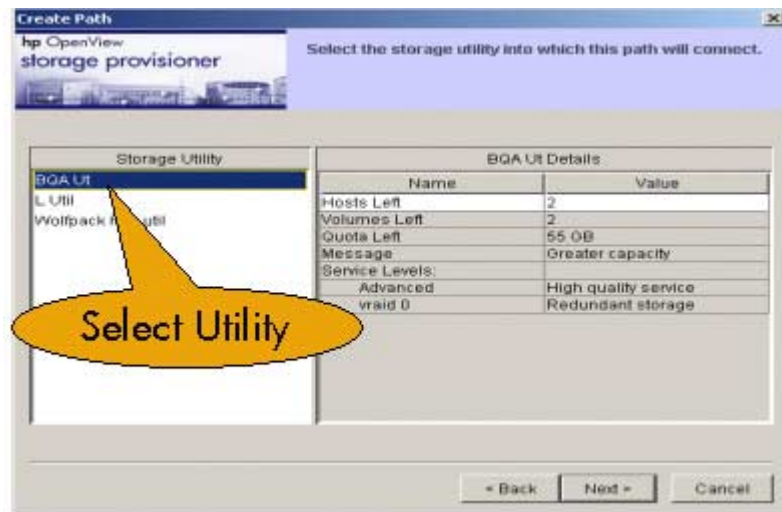
With the path button, you can:

- View existing path information.
- Create paths.
- Modify path information.
- Delete paths.

Creating Paths

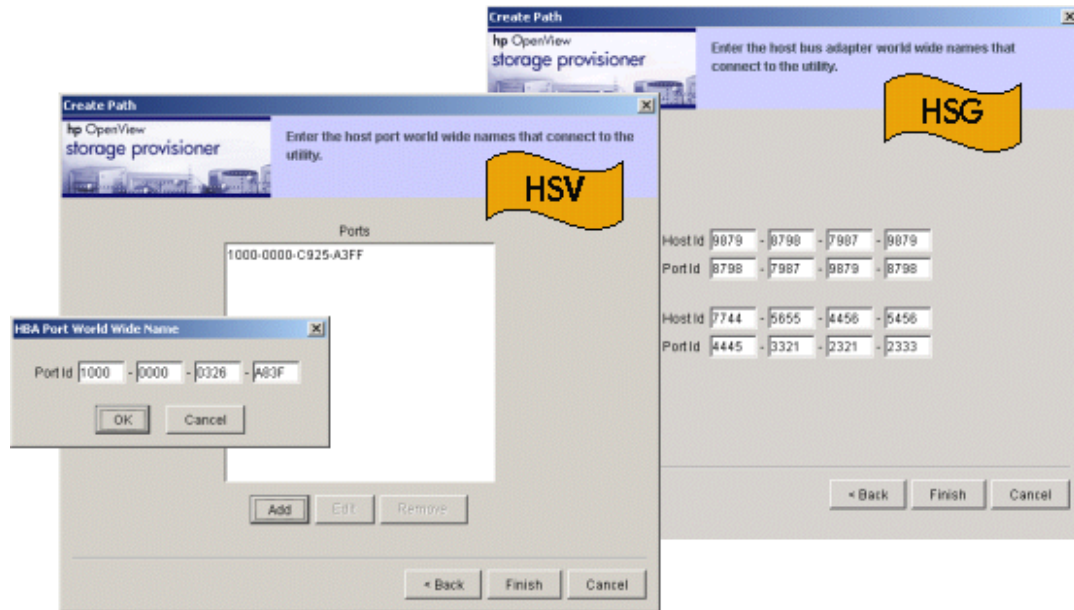
To create a path:

1. Select a host system displayed in the Navigation pane.
2. Click *Path* on the toolbar.
3. Enter the path name and click *Next*.
4. Select the storage utility to associate with the path and click *Next*.



5. Add World Wide Names (WWNs):

- **For HSV-based systems** — Click *Add*, then enter the host port WWN in the window, and then click *OK*. Repeat for each port. When all WWNs have been added, click *Finish*.
- **For HSG-based systems** — Click *Add*, then enter the Host IDs and port WWNs for each path and then click *Finish*.

**Note**

Storage Provisioner does not validate the IDs or WWNs. If you enter an invalid ID or WWN, the connection for the path to the host is not completed. Always verify your WWNs and IDs using either the Command View HSV or HSG Element Manager before entering them.

Volume groups and volumes

Volumes are collections of storage blocks on a storage system, and are visible to hosts through the SAN. The term “volume” is used interchangeably with logical unit (LUN), unit, or virtual disk. Using Storage Provisioner, you can define volume groups to help you manage large numbers of volumes.

Volume Groups

Volume groups are a convenient mechanism to organize large numbers of volumes.

With the volume group button, you can:

- View existing volume group information.
- Create volume groups.
- Modify volume group information.
- Delete volume groups.

To create a volume group, select the *Group* button to the left of the *Volume* button and follow the Window that steps you through the process.

Volumes

You can manage HSV-based and HSG-based volumes that are part of your storage environment.

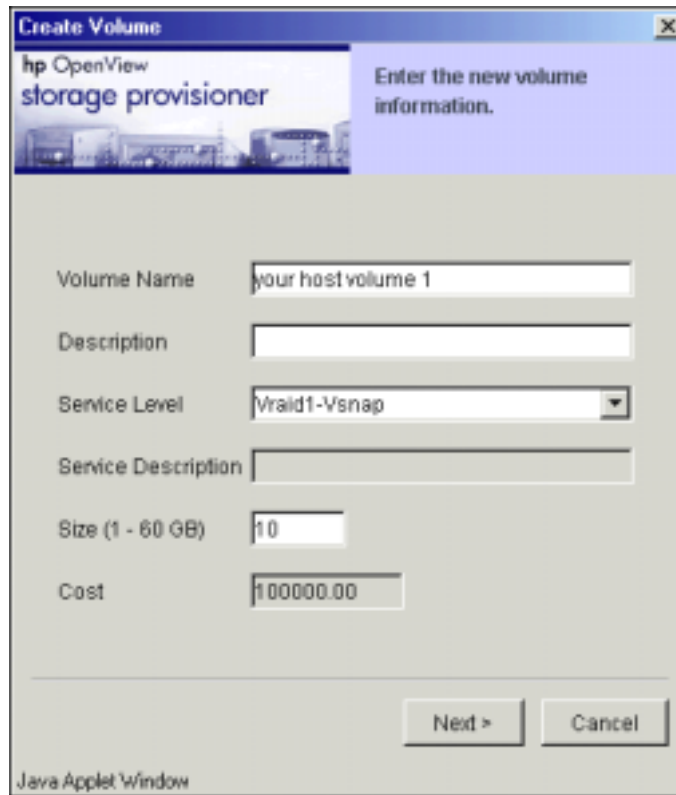
With the volume button, you can:

- View existing volume information.
- Create volumes.
- Modify volume information.
- Delete volumes.
- Access volumes.

Creating volumes

To create a volume:

1. Select a path in the Navigation window
2. Click *Volume*



3. Complete the options in the Create Volume window; description is optional. Click *Next* From *Group* window, select a group if desired
6. Click *Finish*.

Accessing volumes

Note

Before a storage customer can access volumes, a storage provider must set the allocation quota using the Storage Utilities tab. Then, the storage customer can create a host, path, and volume.

To access a volume for allocation:

1. Select a volume listed in the Navigation pane, the **Access** button becomes active.
2. Click the *Access* button.
3. Select a host path from the displayed list.

Note

A warning message may display if you allow multiple hosts to write to the same volume. Click *Yes* to enable this configuration.

- **For HSV-based systems** — The host is removed if no volumes are assigned to it.
 - **For HSG-based systems** — The connection table is edited to remove any connection table entry that is offline and not specifically enabled to any volume. This action occurs for connections on a storage system when a volume is created, deleted, or its access is changed.
4. Click ***Finish*** to complete the action.

Reporting Tools

The Usage Reports tab on the provider view and the Reports tab on the Consumer View display information about activities for customers, storage utilities, and service levels. Additionally, you can export each of the reports to a file, import into a spreadsheet program, and print the spreadsheet report.

The screenshot shows the 'Usage Reports' tab selected in a navigation bar at the top. The main content area is divided into two sections. The first section, titled 'Current Usage', contains two buttons: 'View Volumes' and 'View Quotas'. The second section, titled 'Volume Usage During', contains two input fields for 'Start Date (mm/dd/yy)' and 'End Date (mm/dd/yy)', followed by a 'View History' button.

From the Usage Reports or Reports tab, you can access the following reports:

- Volumes report
- Quotas report
- Billing History report

After the reports are displayed, you can export or print them.

Viewing Reports

Current Usage Reports

To view Current Usage reports:

- Click *View Volumes* — Opens the Current Volume Usage Report

| Current Volume Usage Report | | | | | |
|-----------------------------|----------------|-------------------|---------------|---------------|-----------|
| Storage Utility | Storage System | Name | Customer | Service Level | Size (GB) |
| Baja_QA Util | Baja_QA | hsv vol1 | Bank of Kauai | HSV-VRAID0 | 1 |
| Baja_QA Util | Baja_QA | vol w/ new hsv sl | Bank of Kauai | new hsv sl | 111 |
| Blue only | BLUE | blue vol | Cust | HSG-JBOD | 2 |
| LEFT Util | LEFT | vol w/ new sl | Bank of Kauai | new sl | 18 |
| qa_2 utility | BAJA_QA_2 | vol | Cust | HSV-VRAID0 | 2 |
| Right only | RIGHT | right vol | Cust | HSG-JBOD | 9 |

- Click *View Quotas* — Opens the Quota Report

| Quota Report | | | | |
|---------------|-----------------|--------------|-----------|------|
| Customer | Storage Utility | Quota | Allocated | Used |
| Bank of Kauai | Baja_QA Util | Host | 33 | 1 |
| Bank of Kauai | Baja_QA Util | Storage (GB) | 333 | 112 |
| Bank of Kauai | Baja_QA Util | Volume | 33 | 2 |
| Bank of Kauai | LEFT Util | Path | 2 | 1 |
| Bank of Kauai | LEFT Util | Storage (GB) | 222 | 18 |
| Cust | Blue only | Path | 6 | 1 |
| Cust | Blue only | Storage (GB) | 50 | 2 |
| Cust | qa_2 utility | Host | 6 | 3 |
| Cust | qa_2 utility | Storage (GB) | 250 | 2 |
| Cust | qa_2 utility | Volume | 512 | 1 |
| Cust | Right only | Path | 6 | 1 |
| Cust | Right only | Storage (GB) | 50 | 9 |

Billing History Report

The Billing History report allows you to define a date range and view the volume usage history for that date range.

To view the Billing History Report:

1. Enter dates in the Start Date and End date windows.
2. Click *View History*



Billing History Report (10/1/02 - 10/31/02)

| Group | Customer | Service Level | Volume Name | Storage Utilty | Size (GB) | Created | Deleted | Days | Cost |
|----------------|------------|---------------|-------------------------|-------------------|-----------|------------|----------|------|------------|
| | BoK | JBOD | vol (D1) | L Util | | 9/10/02 | 10/22/02 | 22 | \$0.00 |
| | BoK | vraid 0 | New Volume (New Volume) | BQA Ut | 10 | 10/2/02 | | 30 | \$110.00 |
| | BoK | vraid 0 | vol (vol) | BQA Ut | 3 | 10/1/02 | | 31 | \$33.00 |
| | Cust | Advanced | Volume3 (Volume3) | BQA Ut | 20 | 10/15/02 | | 17 | \$2,000.00 |
| Wolfpack cu... | alpha wolf | Basic | New Volume (D2) | Wolfpack hsg util | | 9/10/18/02 | | 14 | \$225.00 |
| Wolfpack cu... | alpha wolf | JBOD | vol2 (D2) | Wolfpack hsg util | | 9/10/14/02 | 10/14/02 | 1 | \$0.00 |
| Wolfpack cu... | alpha wolf | JBOD | vol (D4) | Wolfpack hsg util | 4 | 10/3/02 | | 29 | \$20.00 |

Export Close

After a report is displayed, you can export or print it.

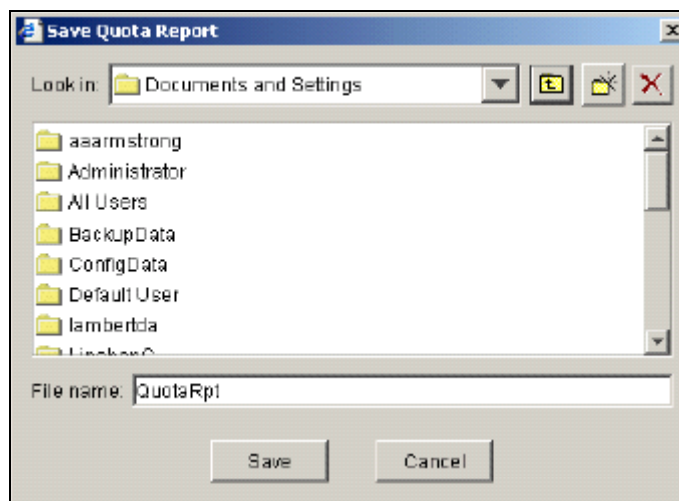
Exporting data

Storage Provisioner enables you to export the Current Usage reports, the Billing History report, or a diagnostic log. To export a report, specify a folder on your system to hold the exported data file. The data is saved in plain text format, delimited by commas. Then use a spreadsheet program to format, display, or print the report.

Note

Before you can export report data, the *java.policy* file must be modified. The procedures to modify that file are listed in the installation section of this student guide.

1. After a report is displayed, click *Export* and the Save Report windows opens.



2. Select a folder, enter a file name, and click *Save*.
Folder names and file names must be less than 30 characters in length.
3. Click *OK* to acknowledge the confirmation message.

Printing Reports

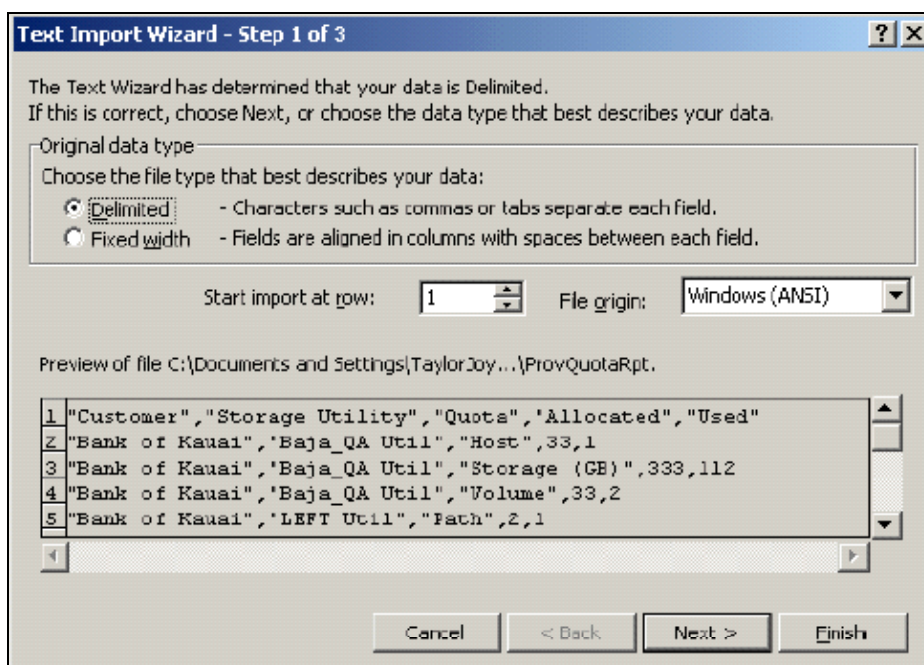
Once you have exported a report, you can use a spreadsheet program to print a formatted report of the information.

1. Open a spreadsheet application. In this example, Microsoft Excel is used.
2. Open the saved report text file.

To open the saved text file, you may need to expand the file display to include all file types.

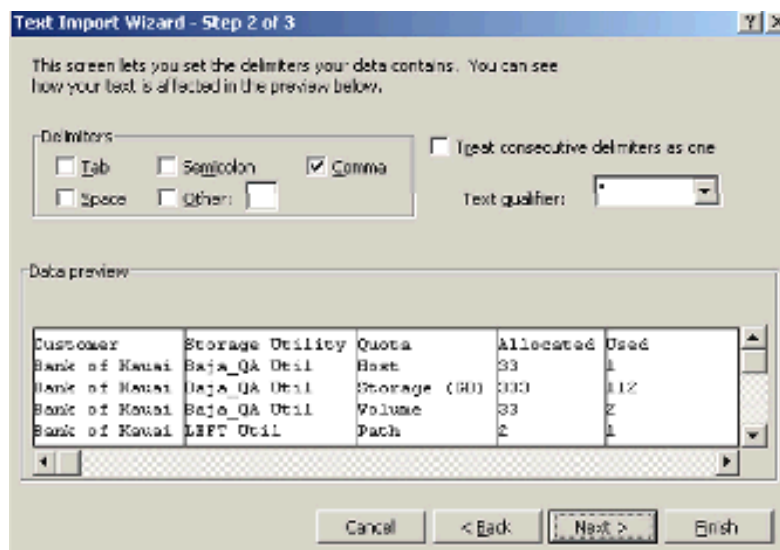
In this example, the file path is *C:\Document and Settings\QuotaRpt*.

The first of three Text Import Wizard screens displays.



3. Select the *Delimited* option in the Original data type section.
4. Click *Next*.

The second wizard screen displays.



5. Select the *Comma* option in the Delimiters section, and set the Text qualifier field to the quote mark (").

6. Click *Next*.

The third Wizard screen appears:

Text Import Wizard - Step 3 of 3

This screen lets you select each column and set the Data Format.

'General' converts numeric values to numbers, date values to dates, and all remaining values to text.

Advanced...

Column data format:

☒ General

☐ Text

☐ Date: MDY

☐ Do not import column (skip)

Data preview:

| General | General | General | General | General |
|----------------|-----------------------|--------------|---------|---------|
| Customer | Storage Utility Quota | Allocated | Used | |
| Bank of Hawaii | Baja_QA Util | Host | 33 | 1 |
| Bank of Hawaii | Baja_QA Util | Storage (GB) | 100 | 112 |
| Bank of Hawaii | Baja_QA Util | Volume | 33 | 2 |
| Bank of Hawaii | LBFT Util | Path | 2 | 1 |

Cancel < Back Next > Finish

7. Select the *General* option in the Column data format section.
8. Click *Finish*.

The report information appears in a Microsoft Excel spreadsheet.

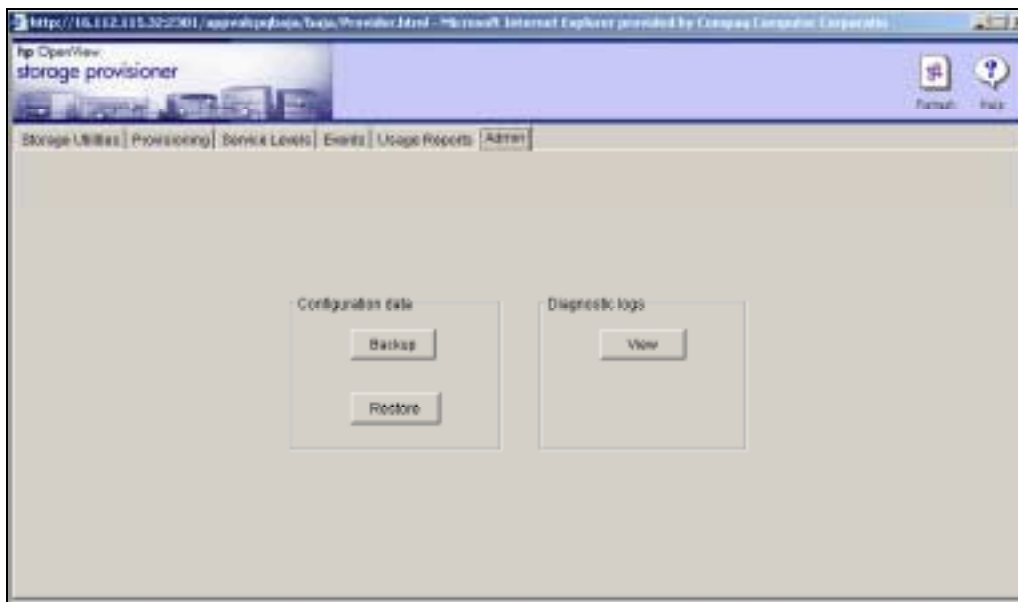
9. Print the resulting spreadsheet.

Maintaining Storage Provisioner

Maintenance of Storage Provisioner includes:

- Backing up your Storage Provisioner configuration data
- Restoring that configuration data
- Viewing, exporting and printing diagnostic logs.

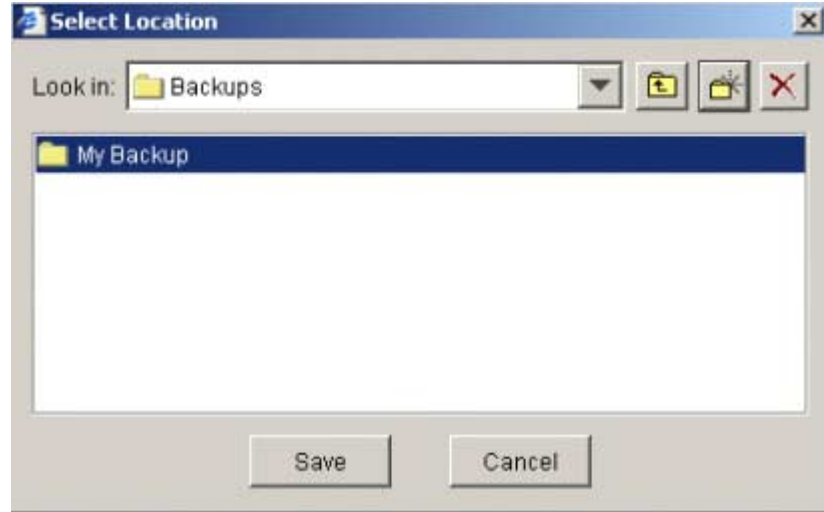
Use the Storage Provisioner *Admin* tab to perform these maintenance tasks.




Backing up data

The backup option allows you to save your Storage Provisioner configuration data to a file on your local system.

1. Click *Backup* and a default folder displays in the folder window.



2. Select the default folder or create a new folder (click the folder icon ).
Folder names and file names must be 30 characters or less in length.
3. Click *Save* then *Yes* in the confirmation window that displays.

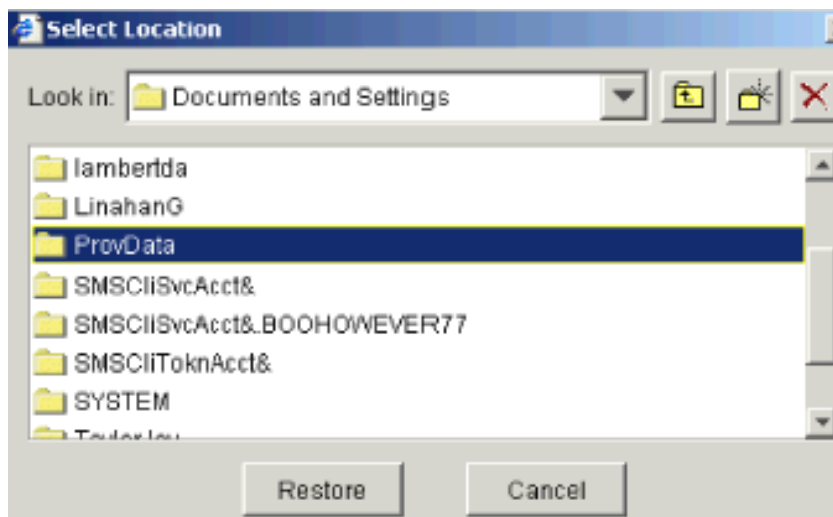
Note

Back up the configuration data after completing the installation and configuration of Storage Provisioner or after making changes to the configuration.

Restoring Data

The restore option provides a method for restoring your provisioning data. If you experience problems with the Storage Management Appliance or Storage Provisioner, you can use this option to bring Storage Provisioner back to a known state.

1. On the Admin tab, click *Restore*. The Select Location window displays.



2. Select the local folder where the provisioning data resides and click *Restore*. If this folder contains additional folders where the data resides; always select the top-level folder.
3. Click *OK* to acknowledge the restore.
4. Click *Refresh*, located in the Session pane, to update the provisioning data. It takes a few minutes for Storage Provisioner to refresh your configuration data.

After you click *Refresh*, Storage Provisioner may display volumes that were created after the backup was performed (unmanaged volumes), or it may display volumes that were removed from Storage Provisioner after the backup was performed (offline volumes).

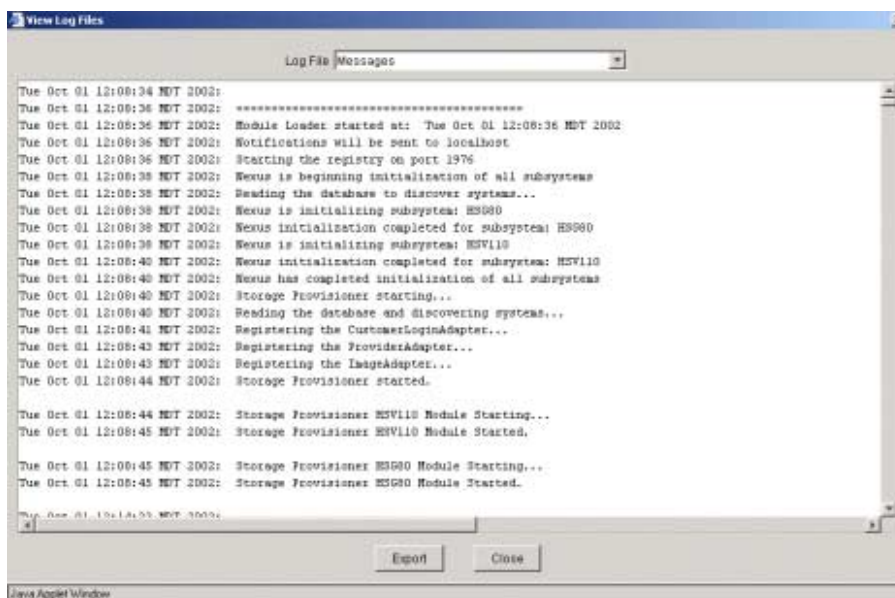
Diagnostics Logs

The Diagnostic log files display two types of logs:

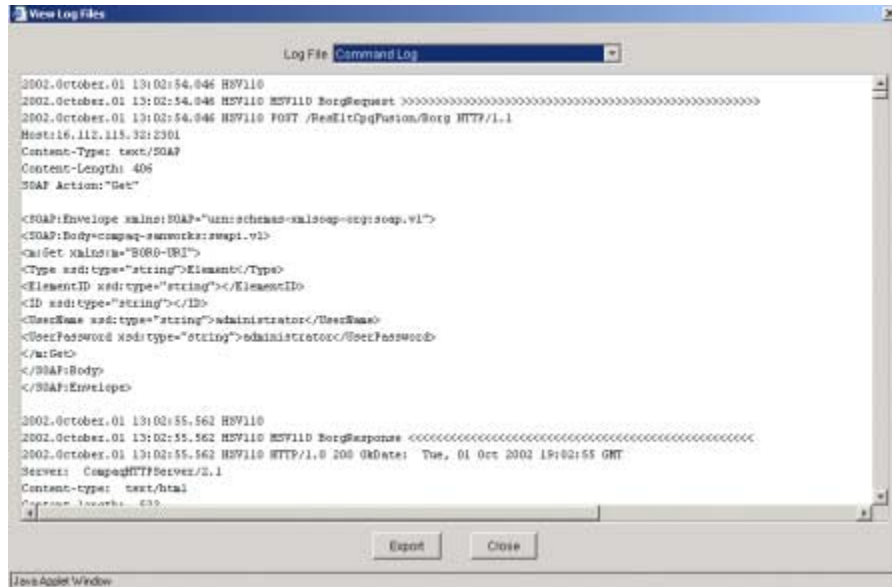
If your storage system is experiencing problems, the diagnostic logs can help the support engineers to understand the problem.

- **Messages** — Displays the status of an issued command.

For example, if you selected *Refresh* from the Session pane, a message displays in the messages log that states, “Refresh started.”

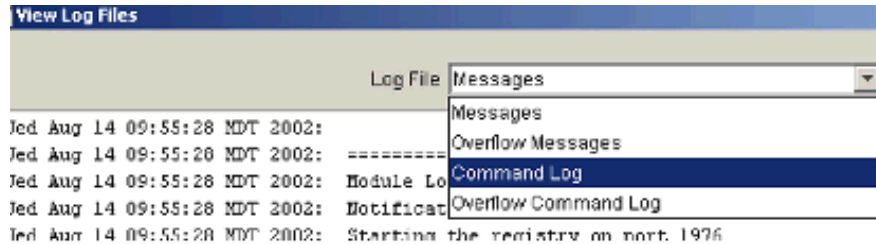


- **Command log** — Displays the code sent to the storage system for an issued command.



To view diagnostic log information:

1. From the Admin tab, click *View*.



2. Select the type of diagnostic message to view from the drop-down list.

When you select a type of diagnostic message and press the *Enter* key, the content changes to display those types of messages.

To export or print the messages or logs, perform the same tasks as when exporting or printing reports.

Troubleshooting

Storage Provisioner provides three types of information to help resolve problems:

- **Diagnostic logs** — Displays information about the actions that occur while Storage Provisioner was performing an operation.
- **Events Tab** — Displays information about generated operations that occurred within Storage Provisioner. The information displays in chronological order listing the most current event first. You can select the Events tab to display the log, review the information using the log, and delete items from the log.
- **Dialog Boxes** — Provides informational messages, warning messages, and error messages.

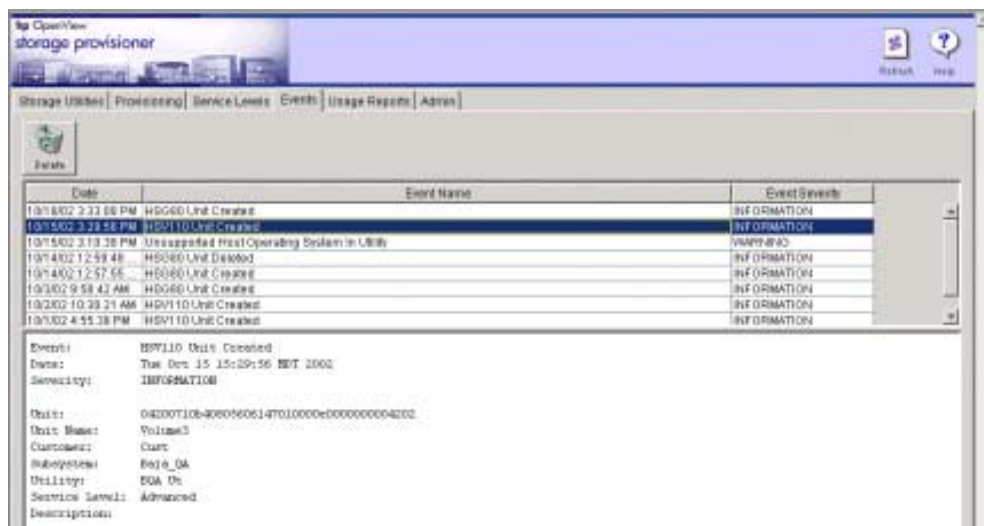
Additionally, different browser issues can affect performance and use of Storage Provisioner. Tips to correct common browser issues are provided.

Diagnostic Logs

The logs and messages discussed in the previous section can also be used to resolve problems.

Events Tab

The Events tab displays information about activities for customers, storage utilities, and service levels.



| Date | Event Name | Event Severity |
|----------------------|---|----------------|
| 10/18/02 2:33:56 PM | H5060 Unit Created | INFORMATION |
| 10/18/02 2:33:56 PM | H50610 Unit Created | INFORMATION |
| 10/18/02 3:13:38 PM | Unsuccessful Host Operating System in Utility | WARNING |
| 10/18/02 12:59:48 | H5060 Unit Deleted | INFORMATION |
| 10/18/02 12:57:55 | H5060 Unit Deleted | INFORMATION |
| 10/18/02 9:58:42 AM | H5060 Unit Created | INFORMATION |
| 10/18/02 10:38:21 AM | H50610 Unit Created | INFORMATION |
| 10/18/02 4:55:38 PM | H50610 Unit Created | INFORMATION |

| | |
|----------------|--|
| Event: | H50610 Unit Created |
| Date: | Tue Oct 15 15:29:56 EDT 2002 |
| Severity: | INFORMATION |
| Unit: | 04200710b-90805606147010000e000000004002 |
| Unit Name: | Volume3 |
| Customer: | Guest |
| Subsystem: | Boja_0A |
| Utility: | BOA_0c |
| Service Level: | Advanced |
| Description: | |

The information displays in chronological order, listing the most current event first. Select the Events tab to display the events log and delete items from the log.

Viewing events

When you select the Events tab, the Navigation and Content panes change to display the Events log.

| Date | Event Name | Event Severity |
|--------------------|-------------------------------|----------------|
| 9/9/02 4:15:43 PM | Supported Path Limit Exceeded | WARNING |
| 9/9/02 2:20:22 PM | Storage Quota Increased | WARNING |
| 9/9/02 1:53:10 PM | HSV110 Unit Created | INFORMATION |
| 9/9/02 12:41:41 PM | HSV110 Unit Deleted | INFORMATION |
| 9/9/02 12:41:25 PM | HSV110 Unit Deleted | INFORMATION |
| 9/9/02 12:41:11 PM | HSV110 Unit Deleted | INFORMATION |
| 9/9/02 12:41:04 PM | HSV110 Unit Deleted | INFORMATION |
| 9/9/02 12:40:55 PM | HSV110 Unit Deleted | INFORMATION |

| | |
|--|-------------------------------|
| Event: | Supported Path Limit Exceeded |
| Date: | Mon Sep 09 16:15:43 MDT 2002 |
| Severity: | WARNING |
| More paths were allocated to a customer than are supported in the utility. | |
| Customer: | Bank of Kauai |
| Health: | LEFT Hail |

The Events log contain the following information:

- **Date** — Time stamp of the event (mm/dd/yy hh:mm:ss xm format)
- **Event name** — Descriptive name of the event
- **Event severity** — Priority given to the event relative to an action. Choices are information, warning, or error.

Dialog boxes

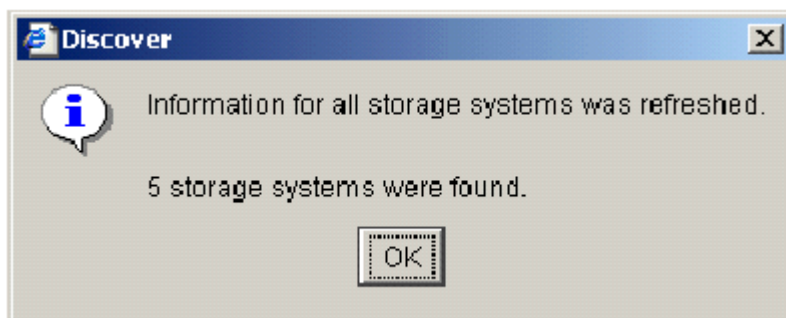
Storage Provisioner notifies you of information, warnings, and errors by displaying messages in dialog boxes. Some of these messages are merely informative and only require that you acknowledge them. While others require an action or decision, sometimes leading you to a wizard that steps you through the process needed to resolve the error.

Informational messages



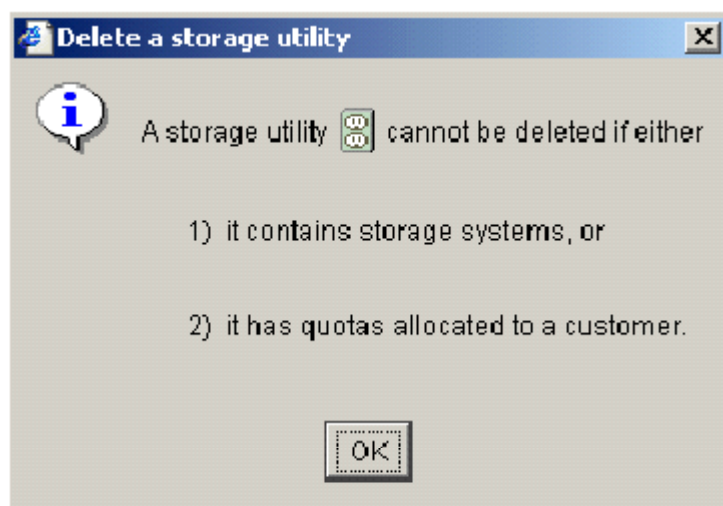
These messages either provide information about why you are unable to execute a certain task in Storage Provisioner, or tell you what you must do next before you can complete a task.

Discover



This message tells you how many storage systems the software found in the SAN after you clicked *Discover* on the Storage Utilities toolbar. Click *OK* to close this dialog box and return to the Storage Utilities tab.

Delete a storage utility



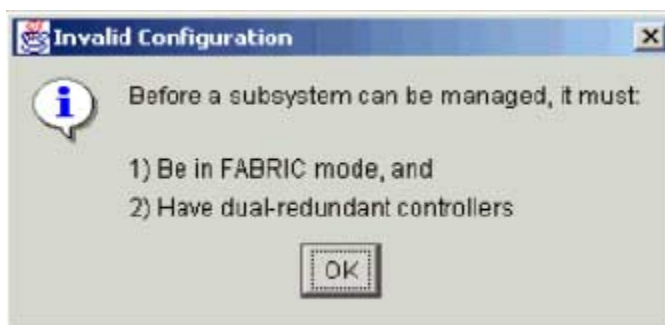
You can only delete a storage utility that is not in use, which requires that both conditions listed in the dialog box be true. Click *OK* to continue.

Grant access to storage utility



This dialog box displays after you click *Quotas* on the Storage Utilities toolbar. Granting access to a storage utility requires that you first specify which storage utility to grant access to, and which customer should receive access.

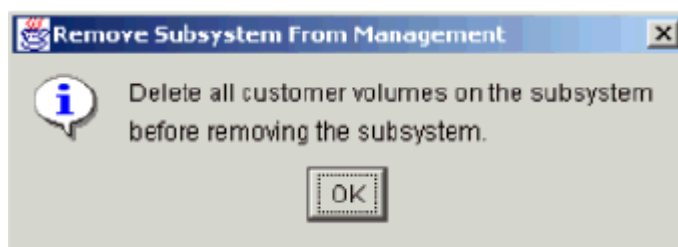
Invalid configuration



A storage system must meet the two configuration requirements listed in the dialog box before you can manage that storage system.

When you click *OK*, the Modify Storage System wizard displays. You must modify the storage system configuration before attempting to modify that storage system again in this wizard.

Remove Subsystem from Management



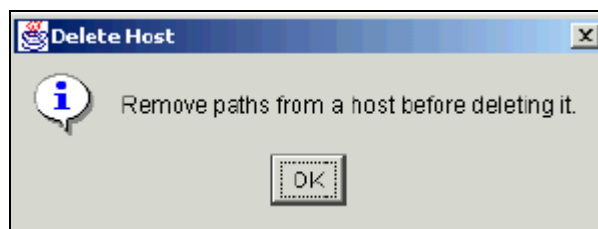
A storage system must be removed from customer use before you can delete it from the SAN.

Change host access to a volume



You must specify a volume before you can change the access of a host to that volume.

Delete Host



A host must have no paths connected to it before you can delete it.

Delete Path



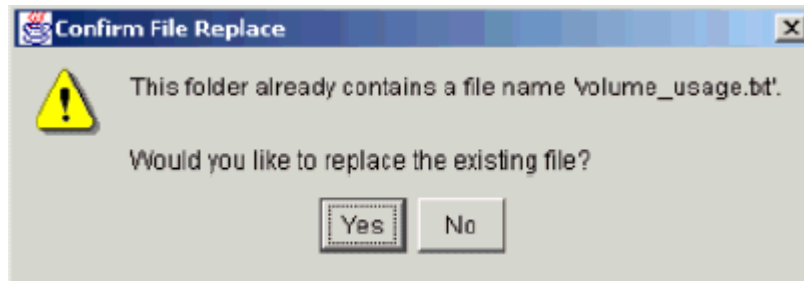
You must disable all volumes connected to a path before deleting it.

Warning messages



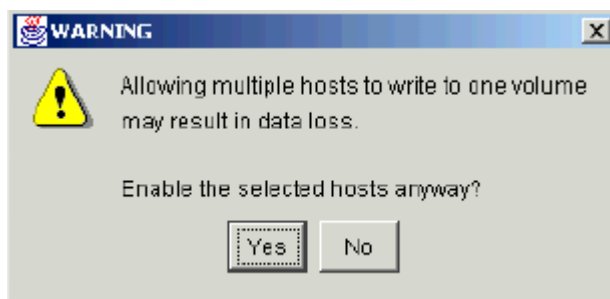
These messages provide information about why you are unable to execute a certain task, along with a question you must answer about how you want to proceed.

Confirm File Replace



Click *Yes* to replace the existing file with your new file of the same name, or click *No* to cancel the operation and return to the Save window.

Warning (general)



When multiple hosts write to the same volume, data loss can occur.

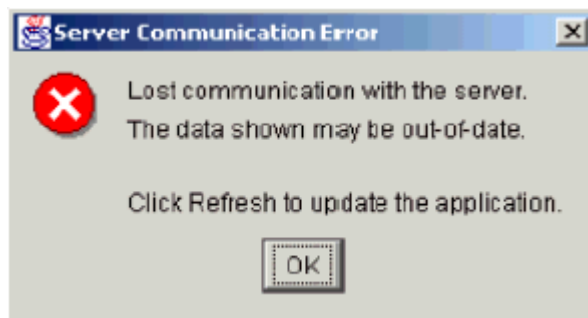
- Click *Yes* to access the selected hosts.
- Click *No* to cancel the operation.

Error Messages



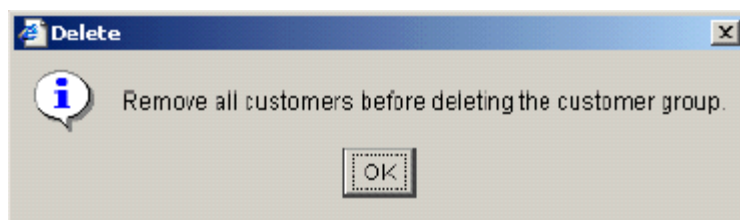
These messages provide information about why an error occurred and, when necessary, what else you need to do to correct the error.

Server Communication Error



This error displays when you try to complete a task that requires data transfer between the server and a client, but the task cannot be completed because the connection between the two machines is down.

Delete (general)



You must delete all customers before deleting a customer group.

Update Error

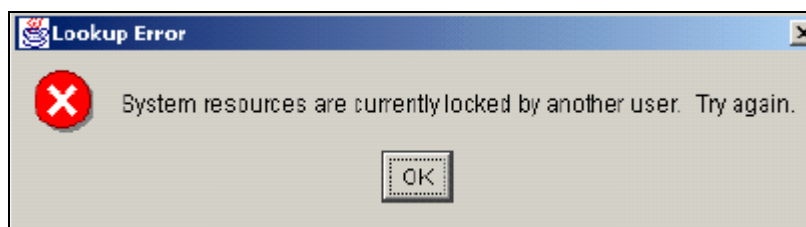


Because the combined storage space in all of a customer's volumes must fit within the customer's quota, the quota size cannot drop below the combined volume size in the utility. When you click *OK*, the Grant Access wizard displays.

Update HBA Error

When creating or modifying a path, you must enter a unique, valid WWN. Storage Provisioner does not validate the WWN. If you enter a WWN that is invalid, the connection from the host to the volume is not enabled. Click *OK* to acknowledge the error.

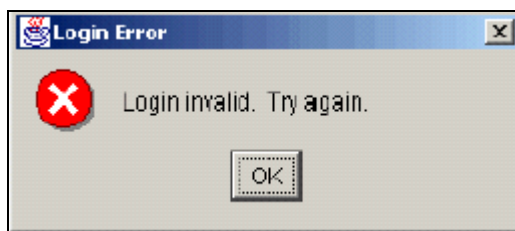
Lookup Error



If multiple users are accessing Storage Provisioner and one of the users has started an operation that could take several minutes, the second user may receive this message if Storage Provisioner cannot access the provisioning data needed.

Storage Provisioner waits two minutes before issuing this message. After the second user clicks *OK*, their request is canceled. The second user should resubmit the request.

Login Error



This error displays in the following situations:

- A customer who has been deleted from the server is trying to log in.
- A customer who has not been set up for access by the provider is trying to log in.

Browser issues

You may experience some browser problems with different versions of Microsoft Internet Explorer and Netscape Navigator. Following are some tips on how to handle these common browser issues:

- Unsupported browsers
- Poor user interface resolution
- Browser window closures
- Application launch display not closed
- Wait indicator disappears
- Operation not canceled

Unsupported browsers

Storage Provisioner supports the same versions of Microsoft Internet Explorer and Netscape Navigator that are supported by the Storage Management Appliance. If you are experiencing a browser problem, ensure you are using a supported version by referring to the Storage Management Appliance Online Help for a current list of supported browsers.

Poor user interface resolution

Most browser applications open with a default setting that provides clear resolution on the screen. However, for older versions of Microsoft Internet Explorer, such as 5.01 with SP1, the default setting may not be clear enough.

1. Click *Start* → *Settings* → *Control Panel*.
2. Double-click *Display*. The Display Properties window opens.
3. Select the *Settings* tab.
 - Select *>256 Colors* (high color or true color) from the Colors drop-down box.
 - Select *1024 x 768 pixels* on the screen area slider bar.
4. Click *OK* to activate your changes and close the window. The next time you open Storage Provisioner, you should have clearer resolution.

Browser window closures

Opening a second Internet-aware application, such as an email program, may cause Storage Provisioner to close because the newly opened program opens in the same browser window. This forces you to relaunch Storage Provisioner each time. To correct this:

1. Click *Tools* → *Internet Options* from the menu bar in your browser. The Internet Options window displays.
2. Click the *Advanced* tab.
3. Deselect *Reuse windows for launching shortcuts* under the browsing list of options.
4. Click *OK* to activate your changes and close the window. This change enables you to open additional applications in separate browser windows.

Application launch display not closed

New storage system information may not display if you do **not** close the application and the launch page before relaunching Storage Provisioner.

For example:

You launch Storage Provisioner, complete your tasks, and close the application, but leave the launch display window for Storage Provisioner open. Later, you click *storage provisioner* from the previously opened launch window to start Storage Provisioner.

Storage Provisioner will open correctly in a separate browser window, and it may seem that everything is in working order; however, any new changes made to a storage system will not be displayed.

This error occurs because your browser does not know that you have closed the application; therefore, recent changes to any storage systems are not displayed.

This problem occurs more often with Microsoft Internet Explorer.

Wait indicator disappears

The wait indicator disappears if you move the mouse off the window. This can occur with both Microsoft Internet Explorer and Netscape Navigator browsers. Storage Provisioner locks the window from any user input until the current action completes.

Operation not canceled

During a long operation (for example, discovery or create volume), the operation is not canceled if the client window is closed. If you exit from Storage Provisioner and close the browser, Storage Provisioner continues the operation until it completes. If another user tries to connect to the server, the user receives a message stating that the resources are locked.

Storage Provisioner Roadmap

At the time of release of this courseware, HP plans to include the next major release of Storage Provisioner in the OpenView Storage Area Manager (OV SAM) 4.0 suite of storage software. Storage Provisioner will be integrated as the fifth module in the suite, replacing Storage Allocator. Customers will be migrated from Storage Allocator to Storage Provisioner.

The Storage Provisioner interfaces will be changed to be more like the OV SAM interfaces. Additionally, any redundancy with Storage Accountant, such as service levels and the cost of service levels, will be removed from Provisioner.

Added capabilities are also planned for release. The intent is to add thresholding and scripting functions like those in Storage Builder. Storage providers will be able to invoke a scripted solution when a volume threshold has been reached.

Increased array support is also planned. The intent is to take advantage of the Storage Networking Industry Association (SNIA) evolving Storage Management Interface Specification (SMI-S) to add additional array support. That support will include:

- XP
- EMC Symmetrix
- Others depending on SMI-S compatibility

Learning Check

1. List the features of HP OpenView Storage Provisioner.

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2. Define the concept of provisioning storage.

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3. Name the two main participants in the process of provisioning storage and list what they manage.

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4. List the steps to create a Storage Provisioner environment.

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5. Describe the restrictions when viewing storage for a storage consumer.

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6. Name the steps to provide access to provisioned storage.

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7. List the reports that can be viewed from the reporting tab.

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8. Name the tasks that can be performed using the Admin tab.

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9. Name the information that Storage Provisioner provides to help you resolve problems.

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HP StorageWorks Business Copy EVA — Concepts and Operations

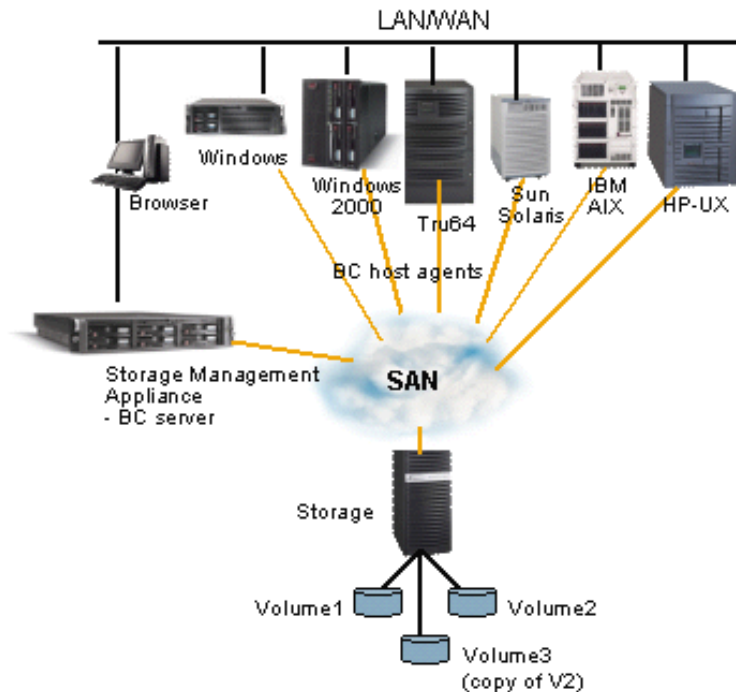
Module 5

Objectives

After completing this module, you should be able to:

- List the purpose, features, benefits and functions HP StorageWorks Business Copy Enterprise Virtual Array (BC EVA).
- Define the replications methods used by BC EVA.
- Describe the purpose, features, and functions of a BC network: BC server, BC hosts and storage subsystem.
- Identify the operations available when creating a BC job.
- Identify the rules for designing and running BC jobs.
- Identify ways to improve performance using the Configuration page.
- Explain how to view the BC Command Line and identify where it resides.
- Compare and contrast BC EVA to HP OpenView Storage Virtual Replicator.

Overview



Business Copy EVA is a controller-based, host-independent application that resides on the HP OpenView Storage Management Appliance. BC allows you to create, run, and manage business continuance volumes (BCVs). A BCV is a generic term that describes a storage unit that is a point-in-time copy of an existing production unit.

Note

The term BCV unit is generic and does not imply the use of any specific technology.

A BC network, which consists of the Storage Management Appliance with BC server installed and multiple host computers, can participate in automated storage unit replication jobs on HSV and/or HSG-based subsystems.

The new BCV unit can be used for:

- **Offline backups** — Backup windows are eliminated by the ability to create instant snapshots of production data.
- **Data warehousing** — Frequent updates to a data warehouse system can be generated with little or no impact to the production system.
- **Testing** — Volumes can be added to another host server for upgrade testing with little or no impact to the production data or the production server.
- **Work distribution** — Clones or snapshots of production data can be accessed by an additional host server for parallel data processing or report generation.

Note

A key feature of a BCV unit is that it is available for multiple uses while the production volume remains online for normal I/O.

A BC network consists of BC-enabled computers that are connected to a common local area network (LAN) and to at least one HSG or HSV storage subsystem.

The BC server software is installed on the Storage Management Appliance and is managed through a web interface, which enables easy management from any system with a supported browser.

The BC agent is installed on host computers that act as potential mount points for BCVs created for by the BC server.

Key features and benefits

Features and benefits of BC include:

- Storage Management Appliance-based BC server architecture
- Controller-based clone and snapshot operations so no additional I/O load is placed on the host
- Support for up to 16 HSV-based storage subsystems in a single BC network
- Support for up to 25 HSG-based storage subsystems in a single BC network



Important

Theoretically, BC can support up to 16 HSV subsystems and 25 HSG80 subsystems. However, from a practical standpoint, BC job execution performance and the responsiveness of the BC GUI are inversely proportional to the number of subsystems being used. Configurations involving more than 10 subsystems may experience long startup and storage refresh times.

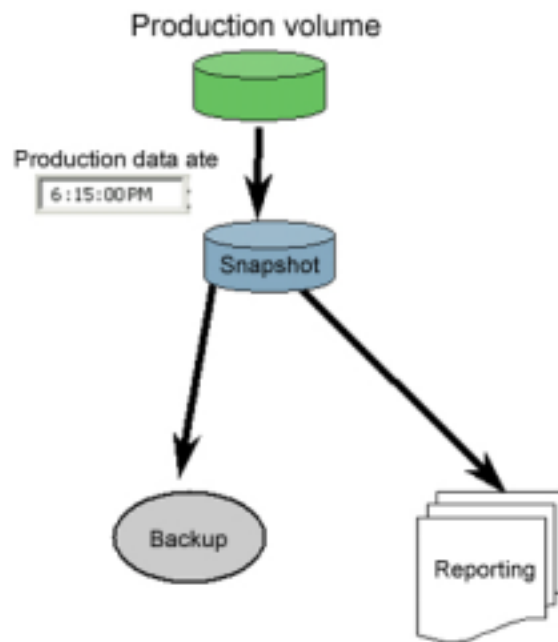
- Ability to include storage from multiple storage systems in a single BC job
- Heterogeneous BC agent host computer support
- Multithreaded job engine that allows multiple jobs to be created or executed simultaneously
- An easy-to-use, intuitive web-based graphical user interface (GUI)
- “LANless” backup support for taking I/O from the LAN and putting it on the SAN where there are fewer bottlenecks
- Rapid shadow set clone creation and break-off from primary sets for faster backups and upgrades
- Fibre Channel switch support
- Data integrity ensured by quiescing the application
- Dynamic mounting capabilities for business continuance volumes (no host restart is required)
- Plug and play with existing applications, Oracle, SQL Server, Microsoft Exchange, Veritas Backup Exec, Veritas Netbackup, Computer Associates ArcServe, and Legato Networker

Replication methods

The two basic methods of replication are snapshots and clones. HSV controllers use a variation of these methods.

Snapshots

A Snapshot is a virtual, point-in-time copy of a volume that is created almost instantly. At the creation of the snapshot, none of the data in the original volume is actually copied. Instead, pointers to that original data are created.



Before changes are written to the original volume, the original data is copied to the snapshot. To ensure that space is available for the copying of the original data (referred to as a copy-out), unused disk capacity equal to that of the production volume is reserved when creating a normal snapshot.

In addition to a traditional snapshot, the HSV controllers can also create a virtual snapshot, or Vsnap. A Vsnap is also referred to as an “allocated on demand” snapshot because unused disk space is allocated as copy-outs occur.

For HSV controllers, up to seven snapshots can be created per virtual disk with a maximum of 255 snapshots per storage array. For HSG controllers, up to four snapshots can be created per storage subsystem.



Note

StorageWorks controller software does not support taking a snapshot of another snapshot.

Clones

A clone is an exact physical copy of an original volume taken at a particular point in time. The process of copying that original data to the new volume is called normalization. The time for normalization depends on the physical size of the volume because the controller verifies identical content on a block-by-block basis for each disk. Normalization may take several hours, and the clone cannot be used until normalization has completed. This traditional type of clone is used by HSG controllers.

To avoid the delay for normalization, HSV controllers use a snapclone. This point-in-time copy starts as a snapshot and becomes a clone after the actual data has been copied to the duplicate volume. The normalization occurs in the background and the snapclone can be used nearly instantaneously because of its initial snapshot attributes. Only one snapclone can be normalizing at a time on a single virtual disk.

The HSG controller can also achieve near instantaneous replication with a clone if each source unit is configured with at least a three-member mirrorset. In that configuration, the controller can instantly split one of the members to create the clone. Normalization may not be necessary if the data written to the original disk has already been copied to the second and third disk of the mirrorset. The timing of those copies depends upon the settings of the mirrorsets and the activity of the controllers. HSG clones can only be created for RAID 0, 1, and 1+0 units.

Comparing clones and snapshots

Clones and snapshots can both be used by a dedicated backup server for offline backups. Using snapshots and clones allows applications to run without interruption. In traditional backups, the application is unavailable during the backup process. Although the snapshot is a virtual copy of the original volume, the original volume is still available during backups but some performance degradation may occur.

Clones are most useful for operations that might change the data, such as production testing or data warehousing. Snapshots are most useful for operations that require a quick copy of the data. For example, snapshots can be made on an hourly basis to ensure a quick restore if files are accidentally deleted or destroyed.

BC modes

BC EVA has two modes, basic and enhanced. The basic mode provides the controller firmware to create snapshots, Vsnapshots, and snapclones using Command View EVA or the Storage Software Scripting Utility (SSSU). User-defined scripts are required for integration with leading database and back-up applications.

The enhanced mode provides a new graphical user interface (GUI) and scripting environment that greatly simplifies storage management by creating, running, and managing storage replication jobs. Using the GUI you can create a BC job that will stop and start applications, mount the BCVs on other hosts, start a backup of that BCV, and then eliminate that BCV to free that disk space for other use.

BC modes for MA/EMA

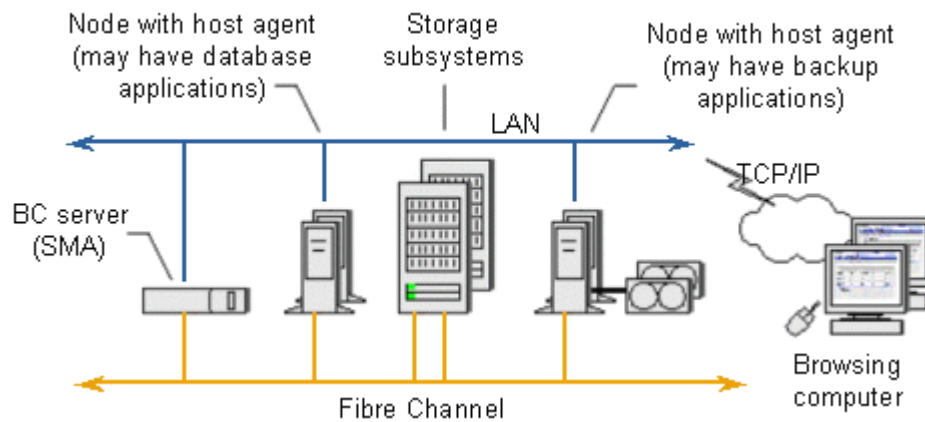
The clone capability is a basic function of the HSG controller. To have HSG snapshot capability, the controllers must have Array Controller Software (ACS) version 8.xS or 8.xP. These versions provide basic clone and snapshot capabilities using the command line interface, the HSG Element Manager or StorageWorks Command Scripter.

For the HSG controllers to use enhanced BC capabilities, HP Business Copy Upgrade UI MA/EMA must be implemented. This product is an improved version of the previously named Enterprise Volume Manager (EVM) and provides functionality similar to that of the BC EVA enhanced mode.

If using HSV and HSG storage in the same SAN, there is no need to purchase BC Upgrade UI MA/EMA. BC EVA Enhanced Mode provides enhanced management capabilities for HSG80 clones and snapshots if the proper version of ACS is being used.

Components of a BC Enhanced Mode Network

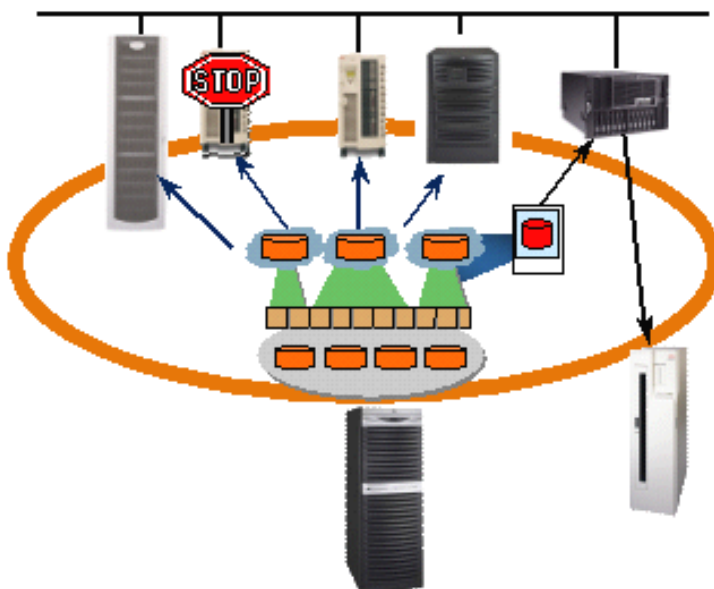
The components included in a BC network are shown in the following figure.



A BC Enhanced Mode network is part of a physical SAN, but uses the TCP/IP of the LAN for communication. The BC network consists of one Storage Management Appliance with BC server software, an unlimited number of nodes with the BC host agent, a node with browser capabilities, and one or more HSV/HSG-based storage subsystems with appropriate controller software.

BC jobs

A BC job is a file created by BC that represents a user's request to perform a task or series of tasks.



Example

A BC job named `daily_sales_backup` might perform the following tasks:

1. Halt or quiesce the database. The database can be suspended, that is, inputs can be stopped and logs committed.
2. Create a BCV.
3. Resume the database.
4. Mount the BCV on another host server such as the backup server.
5. Start the tape backup of the BCV.

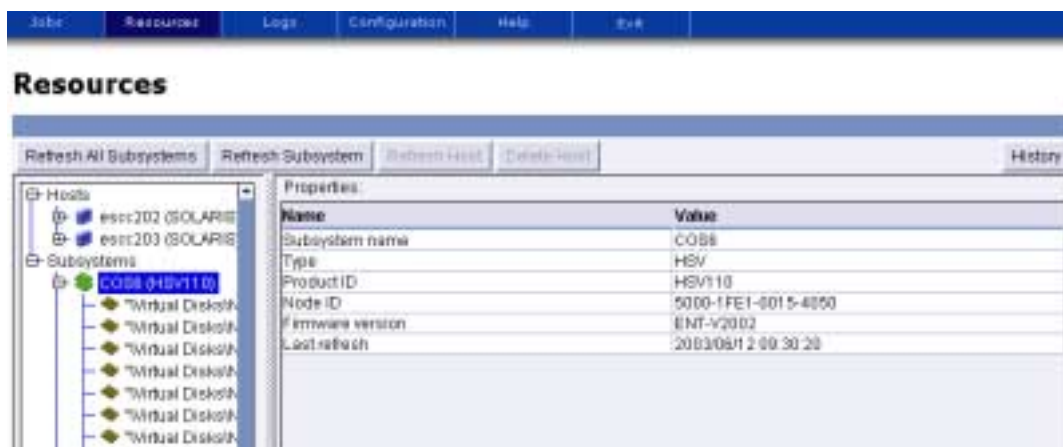
If desired, the job can wait for the backup to complete and eliminate the BCV providing space for other BCVs.

The following subsections cover the procedures for creating and managing BC jobs.

Creating a BC Job

Access the BC home page by browsing to the Storage Management Appliance on which the BC server is installed, and then select *Tools* → *Business Copy*.

The Jobs page is the default page when BC is launched so it is the first page to display. To ensure you have storage systems and hosts visible to the BC server, select *Resources* from the primary navigation bar.



The Resources page includes expandable trees of storage subsystems and BC-enabled hosts — the BC host agent has been loaded. Select a resource to display the properties for that resource. Tabs provide control over requests to discover all resources, or only storage subsystems or hosts. Selecting only specific resources can save time for very large SANs.

When the desired resources are available, select *Jobs* from the primary navigation bar.



Select *Create* on the secondary navigation bar.

Job Create

Edit Save Run History

Name: Class Test Owner: Student Category:

Templates: Select A Job Template

Operation:

- CLONE
- DELAY
- LAUNCH
- LAUNCHUNDO
- MOUNT
- NORMALIZE
- PAUSE
- RESUME
- SET
- SNAP**
- SPLIT
- SPLIT_BEGIN
- SPLIT_FINISH
- SUSPEND
- UNDO

StepSequence

SNAP VOLUME (host_name) (drive_letter_or_mount_point) (\$BCV_variable) (snapshot_type)

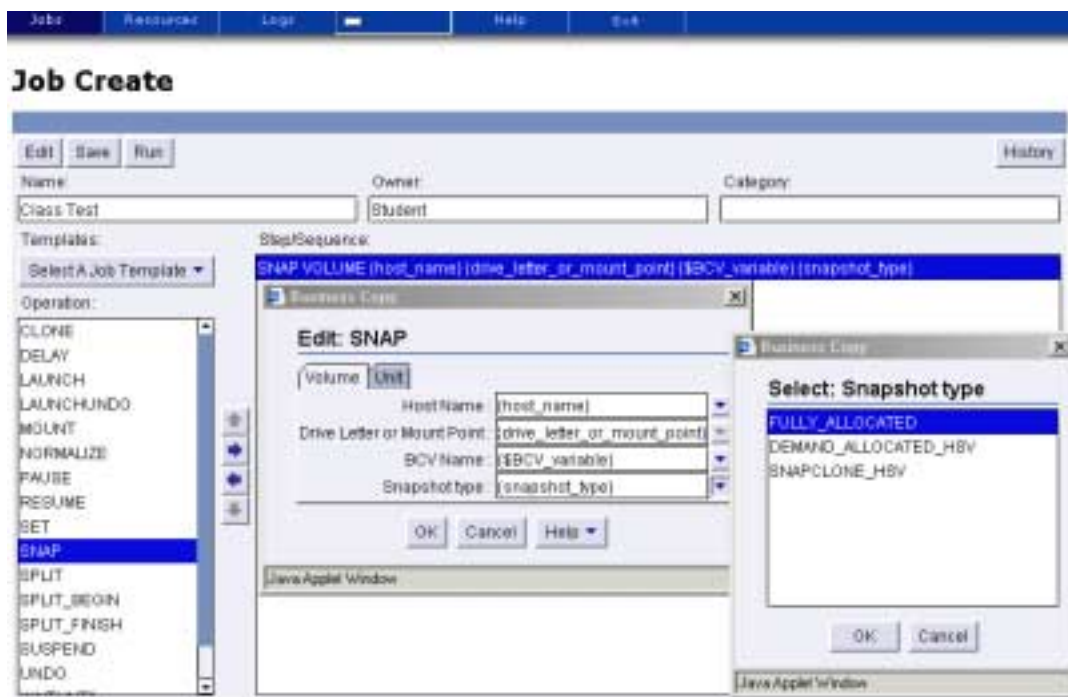
Enter a name for your BC job. Choose a name that reflects the type of activity the job will perform. If desired, in the Owner field, enter the name of the organization or person that is responsible for creating or managing the job. You can also add category information such as Backup jobs or Accounting jobs.

BC jobs can be created manually or by using templates.

BC provides a specialized editor that guides you through the steps for creating a job. The Help features of BC are also an excellent tool to help create jobs.

Creating a BC job manually

To create a job manually, select an operation in the Operation window, and then click the right arrow to enter it into the Step/Sequence window, as illustrated below for a SNAP operation.



After selecting an operation with variables, you must select or enter parameters specific to that operation. Click the drop-down arrow to display the variables for that step, and then select a variable. Double-click or right-click the text to edit the operation.

Creating a BC job with a template

The possible templates are shown below. After selecting a template, steps are displayed in the *Step/Sequence* window. Those steps can then be edited or eliminated.

Job Create

The screenshot shows the 'Job Create' window with the following details:

- Buttons:** Edit, Save, Run, History
- Name:** Class Test
- Owner:** Student
- Category:** (empty)
- Templates:**
 - clone four HSG units.mount
 - clone one HSG unit.quick_split
 - clone one HSG unit.suspend.mount
 - clone one HSG volume
 - clone one HSG volume.mount
 - clone one HSG volume.suspend.mount
 - clone one HSG volume.suspend.quick_split.mount
 - clone two HSG units.quick_split
 - clone two HSG volumes.suspend.quick_split.mount
 - snap one unit
 - snap one unit.mount
 - snap one unit.suspend.mount
 - snap one volume
 - snap one volume.mount
 - snap one volume.suspend.mount
 - snap two volumes.suspend.mount
- Step/Sequence:**
 - one makes a snapshot BCV of a volume *
 - ... SAN and mounts it on a host *
 - ... allocation. If successful, it will return 0 *
 - TRUE INTEGER 0 (host_name) ("command")
 - ... snapshot_type can only be FULLY_ALLOCATED *
 - (unit) (\$BCV_variable) (snapshot_type)
 - ... allocation. If successful, it will return 0 *
 - TRUE INTEGER 0 (host_name) ("command")
 - ... at *
 - ... (" (\$BCV_variable) (host_name) N/A N/A (partition) (drive_letter_or_mount_point)
 - ... (such as a backup job). If successful, it will return 0 *
 - TRUE INTEGER 0 (host_name) ("command")

BC job operations

When creating a BC job, the available operations are:

- **CLONE** — Makes a mirrorset or adds a member to a mirror. CLONE works in conjunction with NORMALIZE and SPLIT operations.
- **DELAY** — Includes timed delays in jobs.
- **LAUNCH** — Issues a command to a BC host.
- **LAUNCHUNDO** — Issues a command to a BC host when undoing a job.
- **MOUNT** — Mounts BCVs as drive letters or mount points on the specified BC host.

- **NORMALIZE** — Checks and waits for a clone to be a completed copy of the original units.
- **PAUSE** — Stops the job at the step containing the PAUSE operation. After stopping the job, BC changes the job status from RUNNING to PAUSED. A paused job remains in the paused state until you issue a CONTINUE command.
- **RESUME** — Issues a command to a BC host to resume I/O activity.
- **SET** — Specifies the disk group in which HSV snapclones are created by BC when the job is run.
- **SNAP** — Creates a BCV unit (snapshot).
- **SPLIT** — Creates a BCV unit (clone) by splitting off a member of a mirrorset.
- **SPLIT_BEGIN** — Starts the creation of a clone by beginning the split of an HSG mirrorset unit (virtual disk). When this beginning phase is completed, BC executes the next step in the job.
- **SPLIT_FINISH** — Completes the creation of a clone by finishing the split of an HSG mirrorset unit.
- **SUSPEND** — Issues a command to a BC host to suspend I/O activity.
- **UNDO** — Initiates an automatic UNDO at the end of a job.
- **WAITUNTIL** — Pauses a user application on a specific host until a user-specified date and time.
- **; (comment)** — Allows the inclusion of comments in jobs.

The CLONE, NORMALIZE, SNAP, and SPLIT operations provide two syntax formats, Unit and Volume.

- **Unit style** — Resources are specified in terms of unit number of the storage subsystem to which they belong.
- **Volume style** — Resources are specified in terms of volume name and the hosts to which they are visible. This syntax is supported on all operating systems and is required to support operating systems that use volume-grouping technology, such as Tru64 UNIX, HP-UX, and IBM AIX.

Jobs page

After completing a number of steps when creating a job and after finishing the building of a job, save the job. HP recommends that you validate a job before running it.

To validate a job, return to the Job page, select a job, and then click *Validate*.

When you validate a job, BC analyzes the job relative to the current storage configuration. Although a job may validate successfully, changes can occur in storage configurations after a job is validated (sometimes within seconds), and the changes can make it impossible to run the job later.

Jobs

| Name | Status | Owner | Category | Updated |
|----------------|----------------|-------|----------|-------------------------|
| BC on EVA Demo | Unds completed | MSCC | | Tue Jun 17 10:38:39 MDT |

From the Jobs page, one can also edit, view job details, run, undo, continue (after a Pause operation), monitor, abort and delete jobs. The History button displays status messages for that page.

Running a job

BC jobs can be run from:

- The BC Jobs page of the web-browser
- The Job Create or Job Edit pages
- A batch or script file
- A scheduler application
- The command line (discussed later in this module)

After a BC job is run, you cannot delete that job until an Undo operation is completed.

Undoing a job

To undo a job, BC runs the job in reverse order, evaluating each step and taking the appropriate action. After undoing the job, any resources used in the original job are returned to their original state. A job cannot be run again until an Undo operation is completed.

Aborting a job

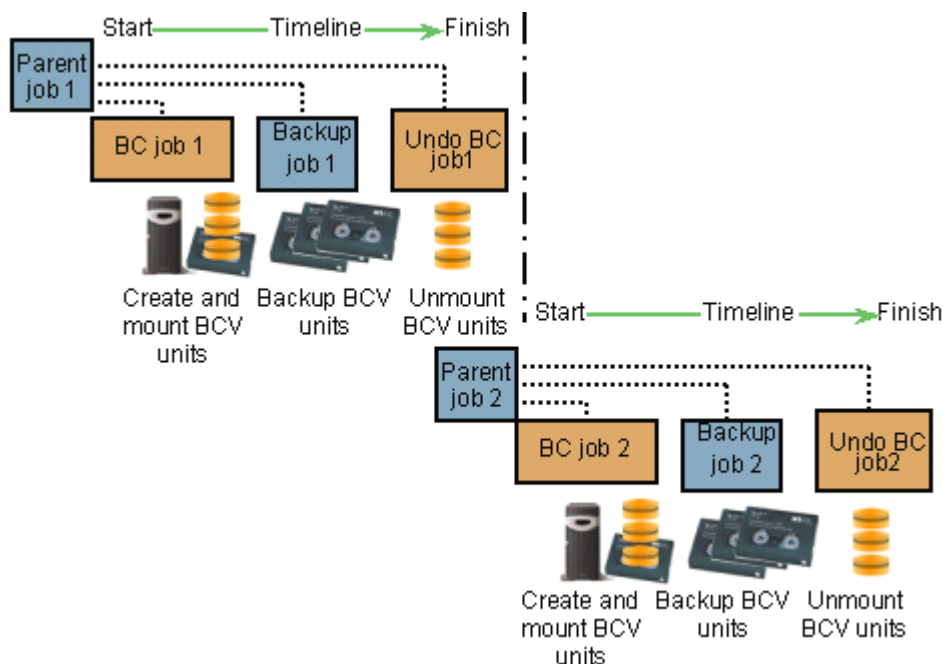
When a job is started, BC commits the resources used in that job. To recover those resources, execute the Undo operation. Running the Undo operation releases the resources and returns the job to a normal state.

Deleting a job

You cannot delete a job while it is running. A job cannot be deleted until an Undo operation is completed.

Sequential jobs

BC jobs can be scheduled to run sequentially using a batch file or a scheduler application. This capability can be valuable for organizations with limited resources and storage capacity or when job outcomes are not predictable. Jobs and batch files can be used with return codes to establish conditional relationships and dependencies between jobs.

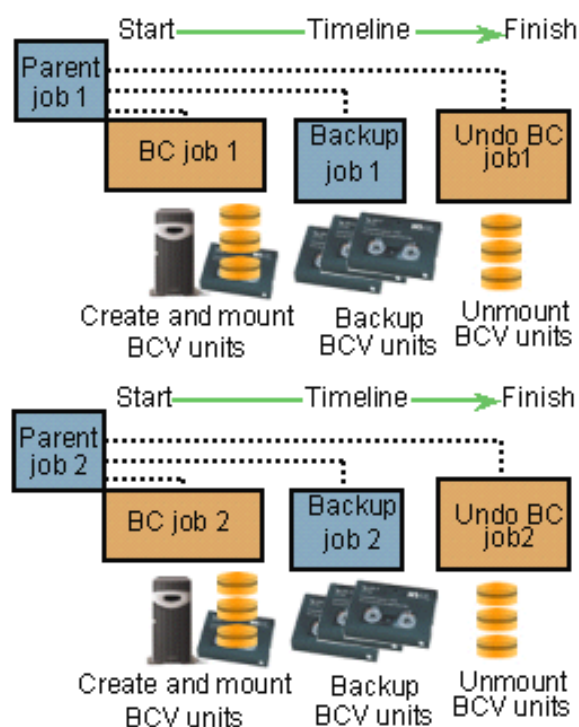


For example, an organization with one storage subsystem, one tape backup unit, and limited free storage capacity could automate its backup procedures.

The organization could: Set up a batch file or scheduler to run BC job 1, followed by Backup job 1, followed by an undo of BC job 1. Undoing BC job 1 frees the required resources to run the next job.

- When the undo of BC job 1 is complete, the batch file or scheduler runs BC job 2, Backup job 2, and the undo of BC job 2. When a snapshot replication method is used, a sequential backup job series essentially takes only as long as the backup procedures require (because the snapshot portion of the process is almost instantaneous).

Parallel jobs



BC jobs can be created as part of a parallel processing system. For example, assume a user is implementing automated backup procedures at a site with one storage subsystem, two tape backup units, and a moderate amount of free disk space.

One solution would be to create several BC jobs and corresponding backup jobs:

1. Use batch files or a scheduler to run parallel jobs series replicating specific storage units.
2. Run the corresponding backup jobs.
3. Undo the BC jobs.

Another possible approach is to:

1. Create one BC job that replicates all of the storage units to be backed up and mounts them as separate units on the backup server.
2. Use a batch file or scheduler to start one backup job for three of the volumes and another backup job for the other three volumes, in parallel.
3. Have the batch file or scheduler run the undo of the BC job after both backup jobs are complete to free the resources.

Job design rules

The total capacity of the storage units being replicated in a job **cannot** exceed the capacity of the free storage on the subsystem.

Each BC network is limited only by the Storage Management Appliance visibility. If a host computer is visible to the Storage Management Appliance, the host can be added to the BC network.

A BC network can support from 1 to 16 HSV storage subsystems and 1 to 25 HSG80 subsystems. However, from a practical standpoint, configurations involving more than 10 subsystems may experience long startup and storage refresh times. To help alleviate this problem, modify the Subsystem Options from the BC Configuration page.

In a single job, you can access up to two different HSV-based storage systems or eight different HSG-based storage systems.

The BC network software places the following limitations on the names of BC created containers:

- Do not begin or end a container name with C! (such as C!12345!C). They are reserved for BC program use.
- The same restriction applies to any container name using the letter S (such as S!12345!S).
- Do not include the following words in any container name:
 - Warning
 - Critical
 - Error

These are keywords used by BC software for processing specific functions.



Caution

Do not change the name of any container created by BC that begins and ends with the sequences C! . . . !C or S! . . . !S

Changing the name of a container created by BC may impact the ability of BC to track that container. If a container name that uses the C! . . . !C or S! . . . !S format is changed, BC will not properly recognize that container. Because BC rules prohibit the BC program from deleting anything that BC storage did not create, the container will not function properly.

Job Design Recommendations

If you are running more than eight jobs, the BC server becomes less responsive to new requests and performance decreases. Even though job execution takes place in parallel, some job operations must be done serially (such as storage and BC host agent access). This imposes practical limits on the number of jobs that can be run simultaneously. Find a way to load balance so all jobs are not running at the same time.

Ensure that unique storage and host resources are specified for any jobs that must be run simultaneously.

A system with more than sixteen users can result in excessive SMA memory usage and can decrease overall GUI performance.

The GUI is slow to respond to requests when running jobs. To reduce long response times, perform all job creation and maintenance operations at a time when no BC jobs are running.

Design groups of small, interrelated jobs rather than a few large jobs. Large BCVs on busy storage systems can take several hours to delete.

Logs

The Logs page allows you to show or delete logs of BC operational events such as job runs and BC configuration reports.

| Jobs | Resources | Logs | Configuration | Help | Exit |
|------|-----------|------|---------------|------|------|
|------|-----------|------|---------------|------|------|

Logs

48 Logs

| Name | Category | Date | Size |
|--------------------------|------------------|------------------------------|-----------|
| bc.tbl | BC Server | Tue Jun 17 15:14:57 MDT 2003 | 4.49 MB |
| bc2.tbl | BC Server | Wed Jun 04 11:17:35 MDT 2003 | 367.27 KB |
| bc3.tbl | BC Server | Tue Jun 03 09:26:00 MDT 2003 | 3.62 MB |
| bc4.tbl | BC Server | Fri May 23 11:07:19 MDT 2003 | 337.98 KB |
| bc5.tbl | BC Server | Thu May 22 12:22:53 MDT 2003 | 326.8 KB |
| bc6.tbl | BC Server | Wed May 21 13:57:06 MDT 2003 | 341.49 KB |
| bc7.tbl | BC Server | Tue May 20 14:28:33 MDT 2003 | 337.41 KB |
| BCsmlog.tbl | BCsm | Wed Jun 04 11:20:36 MDT 2003 | 36.77 KB |
| bcweb.tbl | BCweb | Wed Jun 04 11:20:35 MDT 2003 | 129 B |
| bcweb2.tbl | BCweb | Tue Jun 03 09:28:58 MDT 2003 | 129 B |
| bcweb3.tbl | BCweb | Fri May 23 11:10:07 MDT 2003 | 129 B |
| bcweb4.tbl | BCweb | Thu May 22 12:25:50 MDT 2003 | 129 B |
| bcweb5.tbl | BCweb | Wed May 21 14:00:00 MDT 2003 | 129 B |
| bcweb6.tbl | BCweb | Tue May 20 14:29:26 MDT 2003 | 129 B |
| bcweb7.tbl | BCweb | Mon May 19 15:10:02 MDT 2003 | 129 B |
| Configuration Report.tbl | BC Configuration | Tue Jun 17 15:11:04 MDT 2003 | 307 B |
| ESCC173.host.tbl | Host Info | Tue Jun 17 09:36:41 MDT 2003 | 2.05 KB |
| ESCC173.volumes.tbl | Host Volumes | Tue Jun 17 10:38:39 MDT 2003 | 963 B |
| esc202.host.tbl | Host Info | Wed Dec 11 17:23:00 MST 2002 | 850 B |
| esc202.volumes.tbl | Host Volumes | Wed Dec 11 17:24:13 MST 2002 | 4 KB |
| esc203.host.tbl | Host Info | Wed Dec 11 17:28:16 MST 2002 | 850 B |
| esc203.volumes.tbl | Host Volumes | Wed Dec 11 17:29:16 MST 2002 | 4 KB |
| evm.tbl | | Fri Feb 21 10:32:19 MST 2003 | 522 B |

Configuration

The Configuration page provides access to the following configuration settings:

- Save/Reload
- Subsystem Options
- HSV Options
- HSG Options



Save/Reload

On a regular basis, you should save the BC server configuration and job files that are stored on the Storage Management Appliance to a BC host computer. In the event that a Storage Management Appliance fails, you will not have to rewrite BC jobs from the beginning.

To save the files:

1. Select a host from the Host drop-down box.
2. Click *Save*.

To reload the files:

1. From the Host drop-down box, select the host on which the data was saved.
2. Click *Reload*.

Subsystem options

This page lets you change the subsystem Refresh Interval and Storage Subsystems availability.

Save Select All Deselect All

Save/Reload Subsystem Options HSG Options HSV Options

Refresh Interval:

Specify the refresh interval for detecting storage systems on the Resources Page.

Refresh storage every minutes (not less than 15)

Storage Subsystems:

Select the subsystems that should be managed by Business Copy.
CAUTION: Removing subsystems that are part of BC jobs will result in job failures.

☒ SV3KB
☒ SV3KA
☒ COS6

Modifying these options helps alleviate the problem of long startup and storage refresh times.

Refresh interval

Because successful BC job execution is dependent upon BC having current storage information, periodic refreshes are critical. If the storage configuration changes (for example, through the creation of a new unit or the deletion of an existing unit), BC will not know about the change until a storage refresh occurs. BC jobs might be using old storage information and might fail as a result.

However, refreshes are resource-intensive operations and can take a significant amount of time to complete (as much as 30 seconds per subsystem in extreme cases). Choosing a refresh interval that balances performance with the need for current information is an important part of managing a BC network.

In stable environments, where the storage configuration does not change frequently, a longer refresh period can be used to allow better performance. In environments where storage changes frequently, a shorter refresh interval may be required.

BC automatically detects and refreshes storage system properties based on 5 minutes times the number of storage systems (3 storage systems x 5 minutes = 15 minute refresh rate). As your storage changes, BC will dynamically update the minutes to reflect your environment. You can make the refresh rate longer than what BC calculates, but you cannot make it shorter.

Storage Subsystems

To compile a list of available resources, BC queries every StorageWorks subsystem in the SAN during startup and again at each periodic storage refresh. The Storage Subsystems shows all currently detected storage systems in the BC network.

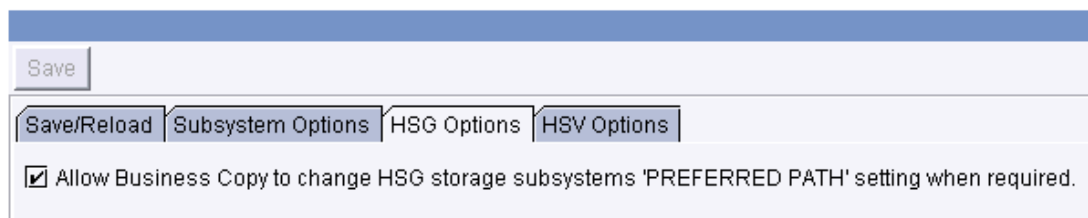
BC considers any storage system it detects to be available for BC jobs. If you do not want a detected storage system to be considered available, you can deselect it. By removing unnecessary subsystems from the BC configuration, the startup and storage refresh completes faster.

You might want to deselect a storage system to:

- Optimize performance in a BC network that includes many storage systems.
- Coordinate jobs with other operations.

HSG options

This page allows the user to select and deselect the HSG preferred path option.

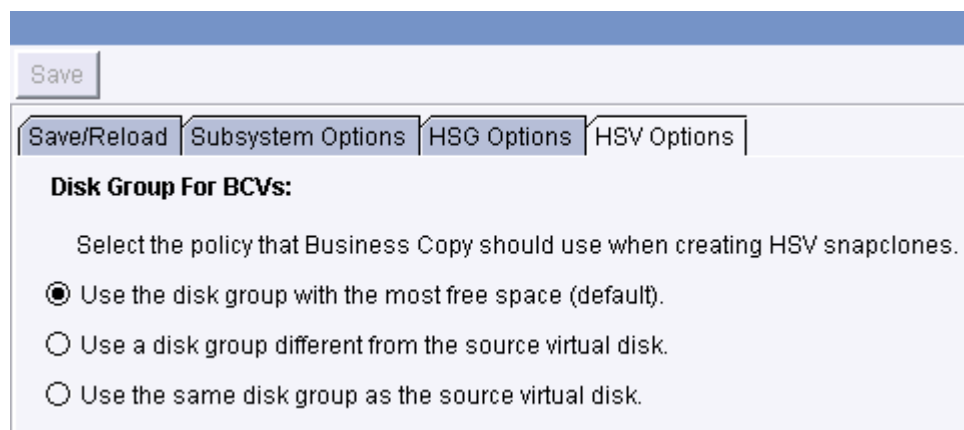


The screenshot shows a web-based configuration interface. At the top is a blue header bar. Below it is a 'Save' button. A tabbed menu contains four tabs: 'Save/Reload', 'Subsystem Options', 'HSG Options' (which is currently selected), and 'HSV Options'. Below the tabs, there is a checkbox labeled 'Allow Business Copy to change HSG storage subsystems 'PREFERRED PATH' setting when required.' which is checked.

For BC to successfully create a BCV, it may temporarily need to change the preferred path of the source unit to match its online state. After the BCV is created, the preferred path is reset to its original state. HP recommends that you select this option so replications are successful. If you choose to disable this option, you should use scripting tools to check the paths to make replications succeed.

HSV options

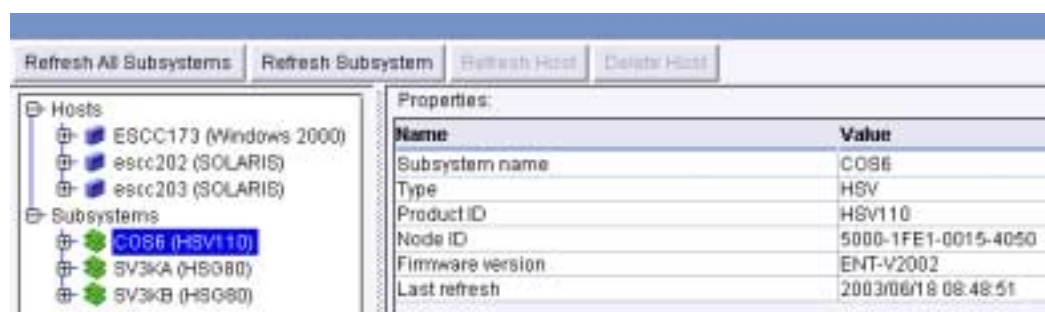
This page specifies the default policy for disk group use when creating an HSV BCV.



You can override this setting using the Set operation when creating a job.

Resources page

Use of the Resources page also can impact performance because it provides the capabilities for manual refresh of BC systems and the deletion of unnecessary hosts.



| Name | Value |
|------------------|---------------------|
| Subsystem name | COS6 |
| Type | HSV |
| Product ID | HSV110 |
| Node ID | 5000-1FE1-0015-4050 |
| Firmware version | ENT-V2002 |
| Last refresh | 2003/06/18 08:48:51 |

Clicking a *Refresh* tab initiates a manual refresh at any time without waiting for the next automatic refresh. Refresh All Subsystems refreshes all storage subsystems. Refresh Subsystem refreshes selected storage subsystems. Refresh Host refreshes selected hosts. Refreshing the appropriate systems after changes may help performance by ensuring that the BC server has accurate data.

Startup and refresh rates can also be improved by eliminating unnecessary hosts using the Delete Hosts tab.

Help

Clicking Help on the primary navigation bar opens a new window providing links to help and user guides for each supported operating system. Click the link to access the appropriate guide.

BC command line

BC command line enables you to issue BC job commands outside of the browser-based graphical user interface.

The host agent provides a command line interface, EVMCL, for creating and running BC jobs that runs on the host.

Note

BC command line displays as EVMCL. Enterprise Volume Manager (EVM) was the previously named version of BC.

The BC command line interface is an executable program that runs on the host computer to provide a simple, flexible mechanism to run a single job or to combine jobs as part of a storage management solution.

With this capability, you can create and save jobs using the BC Server GUI, then execute them later from the operating system command line, batch files, or script files. When used in conjunction with a scheduling application, the BC Command Line feature allows maximum flexibility in the execution of BC jobs.

To issue a command, specify the SMA name, the command, and the BC job name. For example: `evmcl swma31k067 undo Clone_XX` would undo the job *Clone XX* on the Storage Management Appliance SWMA31K067.

BC command line also provides syntax help. Type `evmcl` and return and the following code displays:

```
HP StorageWorks Business Copy Upgrade
evmcl (2.0 build=8) Copyright Hewlett-Packard Company 2003

Syntax:      evmcl <appliance> <BC Upgrade_command> <BC Upgrade_job> [/I]

Switch:      I/=immediate return; null=wait for command to complete
Example:     evmcl swma999999 execute clone_database /I

Commands:   abort      execute      getjoblist      status      statusdetail
            undo       validate

EVMcl is setting default values. Please wait.
Default values successfully installed
For help on evmcl, browse to the BC Upgrade online Help/User Guide
```

Possible commands are listed in the code graphic.

After issuing a command, a return code displays the results. Return codes are:

- 0 — Good status, job complete
- 1 — Good status, immediate return switch is set
- 2 — Not used (can be ignored)
- 3 — Illegal characters were entered for the immediate switch
- 4 — Not used (can be ignored)
- 5 — BC returned an error statement
- 6 — Wrong number of parameters
- 7 — Unknown job command

BC and HP OpenView Storage Virtual Replicator

BC and Storage Virtual Replicator create snapshots of data for backups, data mining, and other operations. However, Storage Virtual Replicator is a host-based software product, which means that it runs on the server and uses server processing cycles. Additionally, Storage Virtual Replicator is only available for Windows-based host systems. Alternatively, BC is controller-based and is host- and server-independent. Therefore, BC agents can be installed on any BC supported operating system that successfully connects to a StorageWorks storage subsystem.

The following table compares the functions and capabilities of BC EVA and Storage Virtual Replicator:

| BC EVA | Storage Virtual Replicator |
|---------------------------------------|--|
| Snapshots, Vsnapshots, and snapclones | Snapshots of snapshots — no snapclone capability |
| Seven snapshots per virtual disk | Twelve snapshots per family |
| Controller-based — No load on server | Host-based — Affects server performance |
| Heterogeneous | Windows only |

| BC MA/EMA | Storage Virtual Replicator |
|--|--|
| Snapshots and clones | Snapshots of snapshots — no clone capability |
| Snapshots require same space as original | <ul style="list-style-type: none"> ■ Does not tie up large amounts of storage when snapshot is initially created ■ Too many snapshots can adversely affect system performance and cause the pool to run out of space |
| Four snapshots per subsystem | Twelve snapshots per family |
| Controller-based — No load on server | Host-based — Affects server performance |
| Heterogeneous | Windows only |

Learning check

1. BC allows you to create and manage _____.
.....
2. Which BC benefit enables host agent support for different types of operating systems?
.....
3. What is the names of the methods of making a virtual, point-in-time copy of a volume, that are created almost instantly?
.....
.....
.....
4. Describe the features of a snapclone.
.....
.....
.....
.....
5. What are the components of a BC network?
.....
.....
.....

6. What storage systems are supported in a BC network?
.....
7. List the two BC modes and describe their characteristics.
.....
.....
.....
.....
8. List the options available from the Configuration page.
.....
.....
.....
9. Describe how the BC Command Line is provided and where it resides.
.....
.....
10. Describe the similarities and differences between BC and Storage Virtual Replicator.
.....
.....
.....
.....
11. Give an example in which the use of Storage Virtual Replicator is more appropriate than BC. Give an example in which the use of BC is more appropriate than Storage Virtual Replicator.
.....
.....
.....
.....
12. What process must complete before a BC job can be deleted?
.....
.....

HP StorageWorks Business Copy EVA — Planning and Installation

Module 6

Objectives

After completing this module, you should be able to:

- Identify where the documentation can be found that lists the operating systems supported by Business Copy EVA (BC EVA).
- Identify the hardware and software installation prerequisites for BC EVA server and host agent software.
- Identify the configuration limitations of a BC EVA network.
- Identify typical BC network configurations.

Overview

This module provides information for setting up BC EVA, which includes assessing your present storage area network (SAN) resources and developing a BC implementation plan.

The BC network can include an unlimited number of hosts and up to 16 HSV and 25 HSG storage subsystems. BC server software must be installed on the HP OpenView Storage Management Appliance (SMA) and BC host agent software must be installed separately on each node within the BC network.



Caution

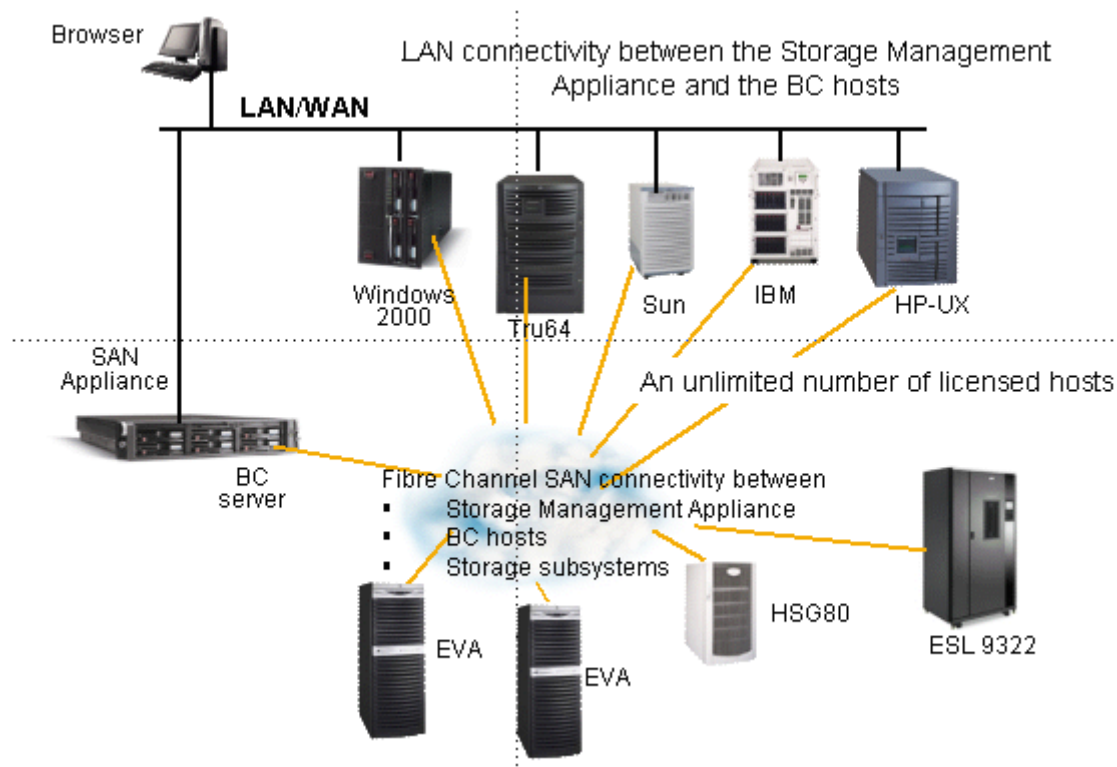
Theoretically, BC can support up to 16 HSV and 25 HSG subsystems. However, from a practical standpoint, BC job execution performance and the responsiveness of the BC GUI are inversely proportional to the number of subsystems being used. Configurations involving more than 10 subsystems may experience long startup and storage refresh times.

This module describes the requirements for installing BC server software on the SMA and BC host agents on computers running a Windows operating system.

Note

Refer to the BC Specification on the HP storage software website for the current BC host agent support.

BC Network Components



The components of a BC network are:

- Storage Management Appliance with BC server software installed and appropriate storage Device Managers (Command View EVA or HSG Element Manager)
- One or more HSV or HSG subsystems
- An unlimited number of licensed hosts with BC host agents installed
- LAN connectivity between the Storage Management Appliance, the BC hosts, and a node with browser capabilities
- Fibre Channel SAN connectivity between the Storage Management Appliance, BC hosts, and storage subsystems

Example

A BC network performs backup operations on a SAN with four Oracle database application servers, one backup server, two HSV-based and one HSG80-based storage subsystems, and one Storage Management Appliance. There are five BC hosts (four application servers and one backup server) and three managed storage subsystems.

BC Server

Each BC network must have BC server software installed on a Storage Management Appliance. The BC server manages the BC network and provides the browser interface for the network.

The BC server requires the following:

- A Storage Management Appliance
- Appropriate device managers (Command View EVA and HSG Element Manager) on the Storage Management Appliance

Note

Refer to the HP BC website for the BC Network Admin Guide for the latest appropriate SMA software.

- Connection to one or more HSV or HSG subsystems with the appropriate controller software
- LAN connection to BC host computers

When the BC server is installed from the CD-ROM, the installation process includes:

- Loading executable files
- Setting up initialization files
- Creating directories
- Copying JRE plug-in files
- Installing a JRE plug-in version on the Storage Management Appliance (if required)

Note

JRE plug-in kits are stored on the Storage Management Appliance for downloading to browsing computers if necessary.

BC hosts

A BC network can have an unlimited number of licensed BC host agents installed. All BC hosts must be online to the HSV or HSG subsystems.

A BC host must have:

- Supported operating system

Note

Refer to the BC Specification at the HP storage software website for the latest supported operating systems.

- LAN connection to the BC server on the Storage Management Appliance
- Connection to one or more HSV or HSG subsystems

A BC host can have:

- Microsoft Cluster Service (MSCS)
- HP Secure Path for the appropriate platform

When installing the BC agent from the CD, the installation includes loading executable files, setting up initialization files, and creating directories.

Planning a BC network installation

To take full advantage of the power that BC provides, HP recommends assessing your present resources, developing a BC implementation plan, and then using this plan to guide installations. Setting up a BC network can involve installing BC software on multiple host computers (any computer visible to the Storage Management Appliance and the storage subsystem).

The basic steps in planning a BC network include:

1. Identifying the purpose of the BC network.
2. Planning the BC server.
3. Planning for BC host agent computers.
4. Completing the BC network planning worksheets.

Note

The BC installation worksheets are included in the appendix at the end of this module.

A BC network is often a subset of an existing Fibre Channel SAN. The SAN consists of host computers, storage subsystems, and switches that are connected with fiber-optic cabling.

In addition, the computers in a BC network are connected by a LAN. They communicate by a transmission control protocol/internet protocol (TCP/IP) connection. This communications infrastructure is critical to monitoring and controlling a BC network.

Identifying the purpose of the BC network

The first step in planning your BC network is to establish a purpose based on which servers will benefit from BC functionality. A BC network can be designed for several different uses including:

- Application testing and batch processing
- Centralized backup
- Data warehousing

After you have identified the purpose of your BC network, identify the BC network components required for your configuration.

Planning the BC server

BC server software is installed on a Storage Management Appliance and controls all BC network activities. The BC agents participate in the BC jobs, as directed by the BC server.



Note

Consider renaming the Storage Management Appliance to a name that could be transferred to a new appliance in the event a replacement is necessary. Refer to the *BC Network Administration Guide* for instructions on renaming and replacing the Storage Management Appliance.

The BC server provides:

- BC job creation and job management functions — Allows the creation, validation, and management of jobs. All BC jobs are stored on the Storage Management Appliance.
- BC resource, job, log, and subsystem views — Provide information to identify available resources, create and manage jobs, log BC activities, and manage subsystem visibility.
- HTTP servers for BC — Allows the use of a web browser to access all of the BC features.
- Communication between the Storage Management Appliance and the StorageWorks subsystems using the device managers.

Planning for BC host agents

BC host agent software is installed on host computers and participates in activities associated with running BC jobs within the BC network. The BC network can be heterogeneous and can combine host computers running any operating system that BC supports.

The BC agent:

- Provides a means for running BC jobs from the BC command line
- Provides communication between the host computer and the BC server
- Participates in BC jobs as directed by the BC server

Every host computer on the BC network requires a BC host agent installation. For a host computer to be selected and included in a BC job, the computer must have BC agent functionality.

Each BC agent host computer connected to the SAN must have a supported host bus adapter (HBA) and the correct HBA driver version. Before starting an installation, verify that the correct HBA and driver are installed.

Migration planning

Migration planning is very important. After the actual migration of an older BC network to a new BC network begins, the migration must be completed successfully the first time through to prevent unnecessary downtime.



Caution

Ensure that migration activities are coordinated with other operations and BC users.

BC network migration considerations

Consider the following when planning for your migration:

- **Do not mix BC versions** — A BC network can only include host computers with the same version of BC installed. After the migration to a new BC version begins, all of the computers in the BC network must be migrated.
- **Understand the impact of stopping BC activities** — When planning to migrate the current BC network:
 - Stopping the Storage Management Appliance stops any BC job running in the BC network.
 - Stopping the Storage Management Appliance stops all browser access to the BC network.
 - Stopping a BC agent service stops any BC job involving the BC agent host computer.

Before migrating any previous BC network to a new BC, verify the following items on the old BC network:

- No affected BC jobs are running.
- No affected BC jobs are scheduled to run.
- All pending BC undo jobs have been run.

To prepare for the migration:

- Run affected BC undo jobs — If BC undo jobs are affected, complete the undo job processes before beginning the migration.
- Print BC job information — Print the job information for all jobs used in the old BC network prior to starting the migration.

Even though BC jobs created in the old BC network cannot be used in the new BC network, the job data may be beneficial.

- Stop the BC service on all host computers.

Note

Refer to the *BC Network Administration Guide — Migration Overview* chapter for the migration steps.

BC network configurations

A BC network can be configured to work with almost any SAN configuration. You can create, execute, and monitor BC jobs from any browser on the LAN.

BC is compatible only with multibus failover configurations and supports only FC-SW environments.

A common BC configuration physically connects heterogeneous hosts through Fibre Channel cables to HSV or HSG subsystems.



Note

Refer to the appropriate documentation for detailed cabling and configuration information.

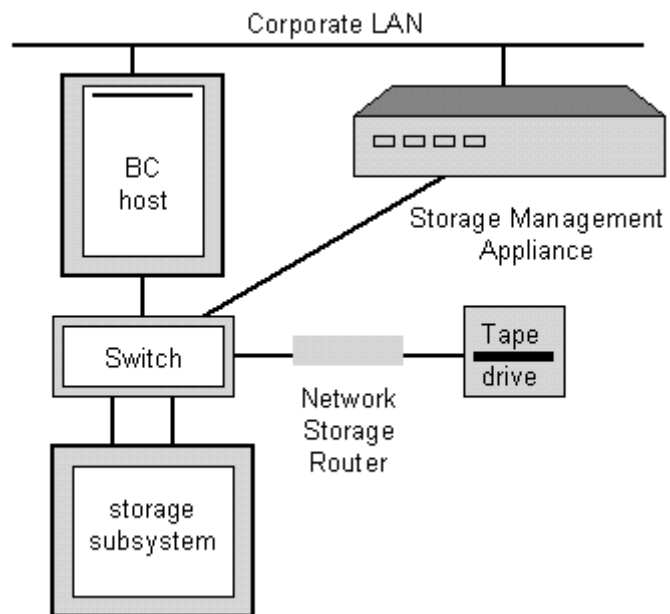
Three typical BC network configurations are:

- Combination application and backup server
- Application servers and backup server
- Clustered application servers and backup server

Note

The following examples are intended as guidelines only. Refer to documentation that came with the StorageWorks subsystem for detailed information on supported SAN configurations.

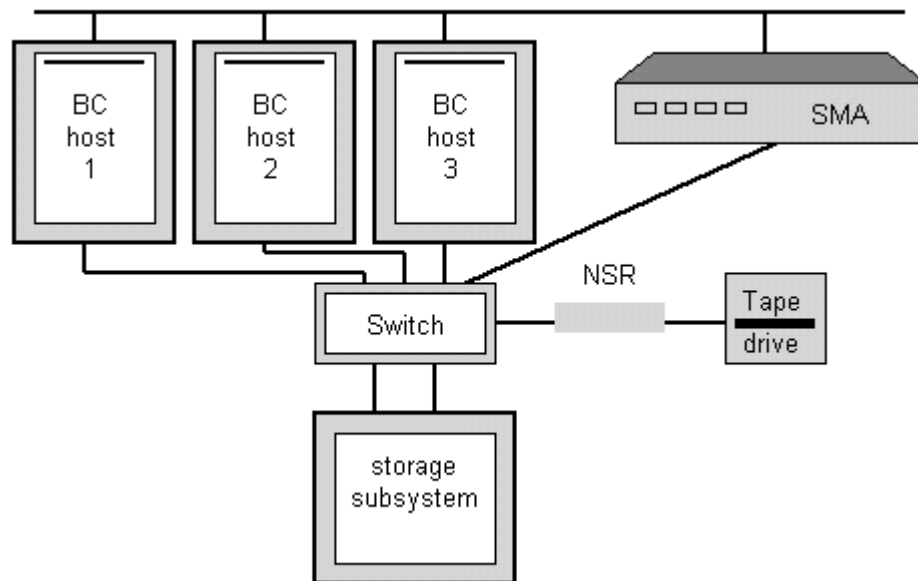
Combination application and backup server



This example is not typical of BC in an enterprise scale implementation; however, it does illustrate BC in a minimum configuration. This configuration could be used to create BCVs and mount them on a single BC host. The BCVs could be used for tape backups or nearline storage.

In this configuration, the BC host has the database applications and tape backup application.

Application servers and backup server

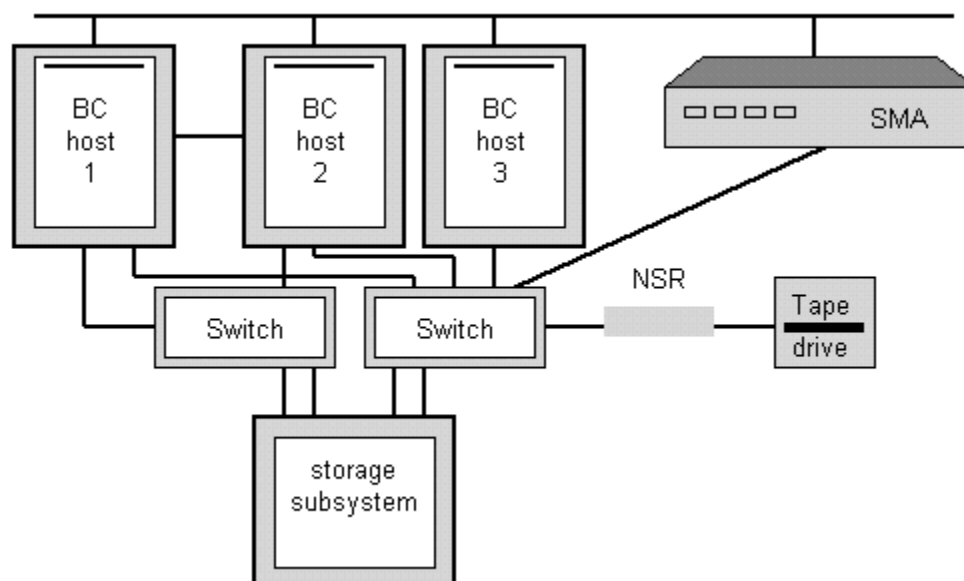


This configuration shows three BC host computers and one storage subsystem. It can be expanded to include many hosts and multiple subsystems that are typically part of an enterprise scale environment.

One possible scenario of this configuration is that BC hosts 1 and 2 are running database applications and BC host 3 is running a tape backup application. BC jobs can create BCVs of databases mounted on BC hosts 1 and 2 and then mount the BCVs on BC host 3 for use in tape backups.

BC can also make BCVs and mount them on BC hosts 1 or 2 to use as nearline storage.

Clustered application servers and backup server



Although BC is not a cluster-aware application, it has been successfully tested in a cluster environment and will run on any member of a Windows cluster.

As in the previous example, the above configuration can be expanded to include many hosts and multiple subsystems.

One possible scenario of this configuration is BC hosts 1 and 2 are clustered in a multipath configuration and running a database application and BC host 3 is running a tape backup application. BC jobs can create BCVs of the databases mounted on the clustered database servers and then mount the BCVs on BC host 3 for use in tape backups.

BC can also make BCVs and mount them on the clustered database server for use as nearline storage.

Learning ceck

1. What lists the operating systems supported by BC host agent software and where is it found.

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2. What is the maximum number of storage systems allowed on a single BC network? What is the practical limit? (p2)

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3. What are the requirements for BC server to manage a BC network?

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4. What are the requirements for BC host agent to participate in a BC network?

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5. Where is the browser located that accesses the BC network?

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.....

6. BC is a cluster-aware application.

- ☐ True
- ☐ False

7. What are the three typical BC network configurations?

.....
.....
.....

Storage Systems Worksheet

| BC Storage Systems | | | | |
|---------------------|------------|-----|-----|---------|
| Storage System Name | Components | | | Remarks |
| | Controller | ACS | VCS | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |

Host Computer Worksheet

| BC Host Computers | | | | | | |
|--------------------|------------|---------|--------------|-------------|------------|-------|
| Host Computer Name | Components | | | | BC Version | Tasks |
| | OS | FCA HBA | Solution Kit | Secure Path | | |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |

