

Selling HP Enterprise Storage Solutions

ESG17412SG0402



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HP Training

Student guide

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Selling HP Enterprise Storage Solutions

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Overview and introductions

Objectives

After completing this module, students should be able to:

- State the goal of this course.
- Identify the objectives of this course.
- Identify types of courses within the Network Storage Solutions sales training curriculum.

Introduction

Welcome to *Selling HP Enterprise Storage Solutions*, a sales course that provides an overview of the enterprise storage marketplace, selling strategies, key customer business issues, storage competitors, storage products and solutions, and selling resources.

Selling HP Business Class Storage Solutions is the complementary course for *Selling HP Enterprise Storage Solutions*. Together, both courses provide sales training on the complete line of HP network storage products and solutions.

Course goal

The goal of this course is to help salespeople create value in the eyes of their customers regarding the business benefits of HP enterprise storage solutions, and to sell those solutions effectively.

Course objectives

At the end of this course, students should be able to:

- Describe the storage market and business opportunities for enterprise storage solutions.
- Apply a business value model to selling enterprise storage.
- Use storage opportunity worksheets as part of account planning.
- Summarize the HP corporate vision, mission, and strategy and the Adaptive Enterprise.
- Describe storage virtualization.
- Articulate enterprise storage solution value propositions for the full portfolio of HP enterprise storage solutions.
- Describe key enterprise storage services.
- Be able to articulate to customers the most appropriate solutions for their business needs.
- Describe HP enterprise storage solutions competitive advantages.
- Know where and how to locate selling resource information.

Note

This course does not describe basic storage technology fundamentals. See *HP Storage Sales Builder WBT* for technology fundamentals.

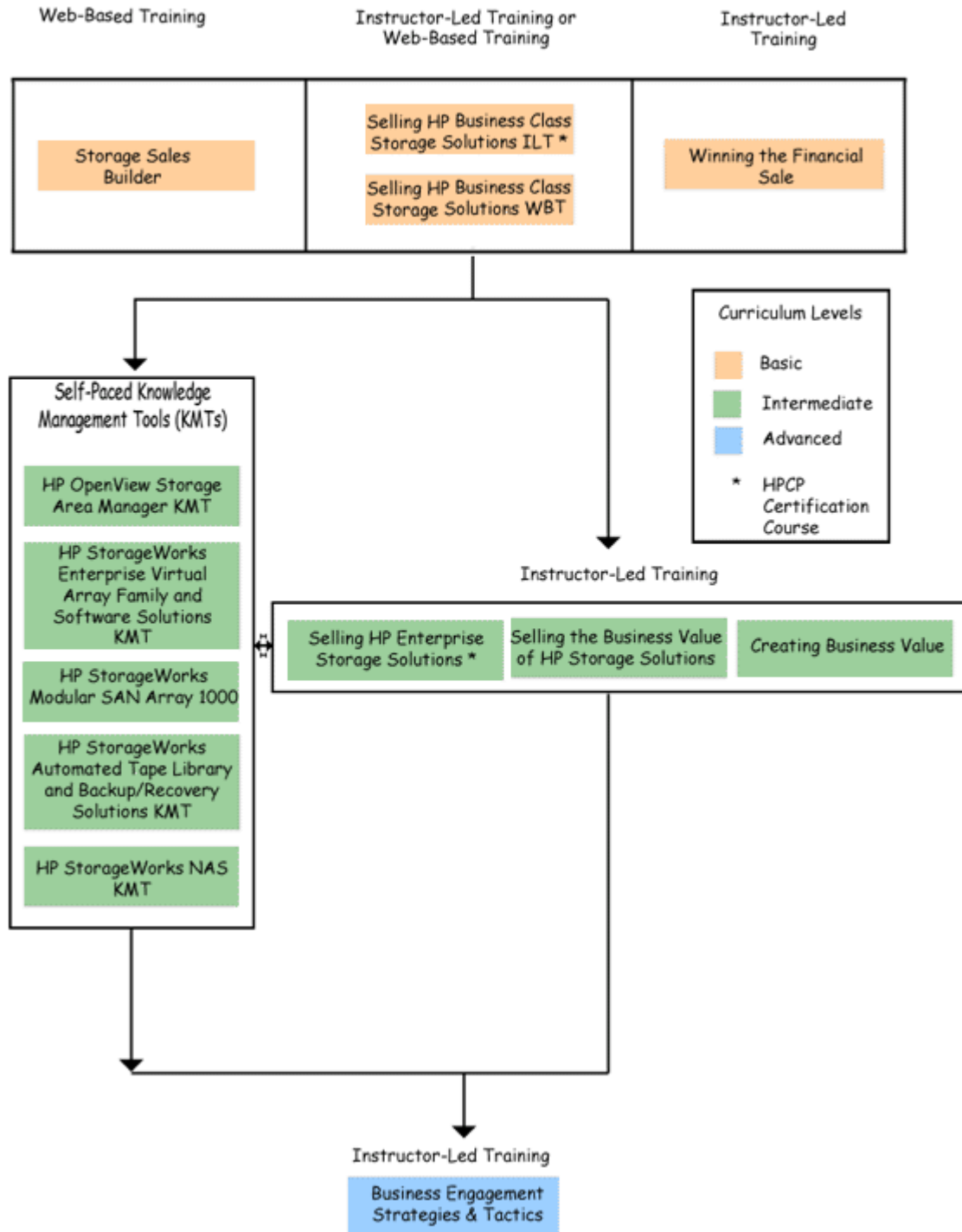
Audience

This training is intended for partners, newly hired sales generalists and storage sales specialists, and call center storage representatives.

Network Storage Solutions sales training curriculum

NSS Sales Training Curriculum (Recommended)

The goal of the NSS sales training curriculum is to help salespeople create value for their customers.



Course descriptions

Course	Content
Basic	
Storage Sales Builder	Describes basic storage technology to sales representatives who are new to storage technology. With information from this course, sales representatives can improve how they identify storage opportunities during their interactions with customers.
Selling HP Business Class Storage Solutions	Provides an overview of the business class storage marketplace, basic storage technology, business class storage products and solutions, business class competition, and selling resources.
Winning the Financial Sale	Addresses the increasingly competitive and value-driven enterprise storage marketplace as well as the financial and business value requirements that senior decision-makers are demanding from IT solution providers.
Intermediate	
Selling HP Enterprise Storage Solutions	Describes enterprise solutions, market opportunities, enterprise competition, and selling resources.
Selling the Business Value of HP Storage Solutions	Introduces business value concepts as applied to SAN solutions and the business value model software tool from ITCentrix.
Creating Business Value	Provides sales/customer teams with a value generation and strategic thinking process that focuses on understanding the customers' business needs and developing value-based offers that leverage a company's core competencies.
HP StorageWorks Knowledge Management Tools (KMTs)	<p>Offer web-based sales training that focuses on specific storage solutions, market opportunities, configurations, competition, and selling tips.</p> <p>The following KMTs are offered:</p> <ul style="list-style-type: none"> ■ Automated Tape Backup Library and Backup/Recovery Solutions KMT ■ HP StorageWorks Enterprise Virtual Array Family and Software Solutions KMT ■ HP StorageWorks Modular Storage Array Family KMT ■ HP OpenView Storage Area Manager KMT ■ HP StorageWorks NAS KMT
Advanced	
Business Engagement Strategy and Tactics	Provides practice in developing and applying key customer business knowledge to advance business relationships. This course also explains how to adapt a business dialog for successful customer engagements at any level or within any functional area.

NSS Accredited Sales Consultant certification

In addition to reviewing this student guide while preparing for the HP Certified Professional NSS Accredited Sales Consultant certification test (HP2-960), you should also review each of the intermediate KMTs listed in this module.

Prerequisites

Selling HP Enterprise Storage Solutions is an intermediate level course, intended for students whose sales tasks include being able to present and explain technology and application solutions in order to solve customer problems at the enterprise level.

Typically, a student will have 2 years of industry selling experience and at least 6 months of experience selling storage products and solutions before taking this course.

Students should complete the *Selling HP StorageWorks Business Class Solutions* course (web-based or instructor-led) before beginning this program.

Course agenda

Topic	Description
Day 1	Overview and introductions
	Mapping business needs exercise
Module 1	Enterprise SAN market opportunities
Break	
Module 2	Enterprise storage business value sales model
Module 3	Exercise — HP enterprise storage solutions opportunity worksheet
Break	
Module 4	Enterprise vision, mission and strategy
Module 5	Network storage solutions product portfolio
Lunch	
Module 6	Storage virtualization
Module 7	HP StorageWorks XP
Break	
Module 8	HP StorageWorks Enterprise Virtual Array
Module 9	HP OpenView Continuous Access Storage Appliance (CASA)
Module 10	HP StorageWorks Virtual Array
	Homework Exercise
Day 2	
	Exercise
Module 11	HP StorageWorks NAS solutions
Module 12	Storage backup and archival systems
Break	
Module 13	HP StorageWorks SAN Interconnect solutions
Module 14	HP OpenView Storage Area Manager
Lunch	
Module 15	HP OpenView Storage Data Protector
Module 16	Enterprise network storage services
Break	
Module 17	Enterprise storage competition
Module 18	Enterprise storage selling tools and resources
	Exercise
Review/test/evaluation	

Course materials

- Student Guide

Student introductions

Please provide the following information to the class:

- Name
- Organization
- Job/function
- Years of sales experience
- Territory/account assignments
- General storage experience
- Course expectations

Summary

The goal of this course is to help salespeople create value in the eyes of their customers regarding the business benefits of HP enterprise storage solutions, and to sell those solutions effectively.

This course focuses on customer needs and the business value of HP storage solutions. Business class storage solutions are covered in the *Selling HP Business Class Storage Solutions* course.

Enterprise SAN market opportunities

Module 1

Objectives

After completing this module, students should be able to:

- Describe current trends in the enterprise SAN market.
- Identify the key players in the disk storage market.
- Identify the customer requirements of HP enterprise SAN opportunities.

Overview

The enterprise storage market continues to offer significant revenue opportunities. Predictions are that growth in the overall storage market will continue and that storage will play an increasingly large part of information technology planning.

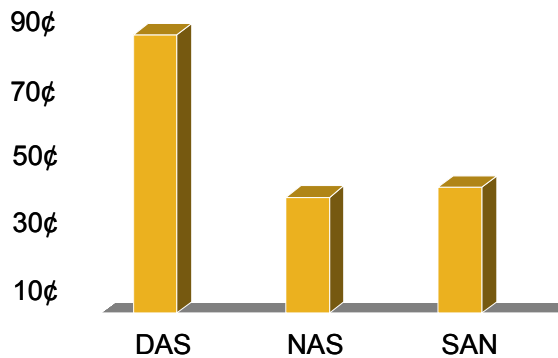
This module provides an overview of the enterprise storage market, anticipated trends in the market, the current competitive position of suppliers in the SAN market, and customer requirements typical of HP enterprise SAN opportunities.

Why network storage?

More companies are investing in network storage solutions each year. Although the purchasing costs of DAS solutions may be lower than network storage, customers now realize that DAS does cost them more in the end.

IDC estimates that by 2006 storage networks will account for more than 70% of storage (IDC, Worldwide Disk Storage System Forecast, October 2003).

3-year TCO (cents per MB) for 2TB



Source: "The Storage Report," Merrill Lynch, McKinsey & Company, June 2001

Storage networks lower the total cost of ownership by enabling:

- Server consolidation
- Storage consolidation
- Backup consolidation
- Management consolidation
- Technology consolidation
- Lower total cost of ownership

Why sell SANs?

- SANs demonstrate business value that customers understand.
 - SANs provide increased storage utilization, compelling ROI, and reduced administration costs.
- SANs increase revenues and margins.
 - SANs increase incremental revenue by 15–30% per deal.
- SANs are the foundation for future sales.
 - Every \$1 in SAN revenue creates \$18 in storage, server, and services revenue (according to HP Field Marketing analysis).
- SANs are widely deployed.
 - 80% of Fortune 1000 companies have/will deploy a SAN within 12 months.

Delivering on business value

HP SANs provide business value advantages:

- Greater business flexibility
- Improved efficiency
- Higher service levels

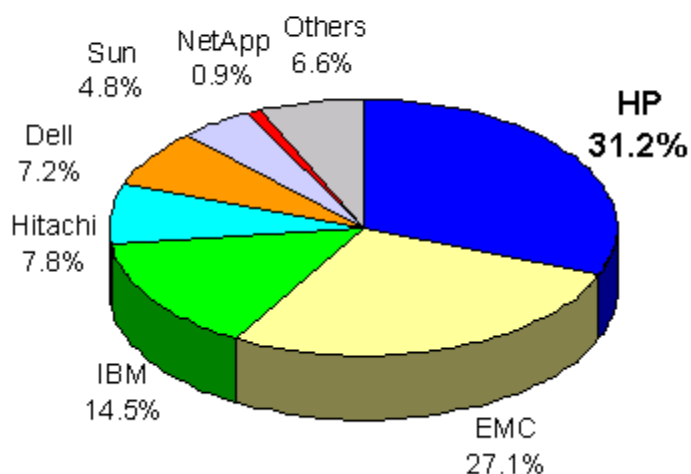
HP SAN industry leadership

- HP has installed more SANs than the next three competitors combined.
- HP ships three times more SAN attached storage than the nearest competitor.
- HP has the largest installed base of SAN fabrics in the market with over 1,000,000 FC switch ports installed.
- HP has the largest base of SAN-certified engineers in the industry.
- HP supports the largest fabrics in industry.
- HP is the leading SAN service provider with over 2000 successful SAN implementations world-wide.

Open SAN market share

For the fifth straight quarter, HP is the leading Open SAN vendor with 31.2% revenue share, leading EMC by 4.1 percentage points.

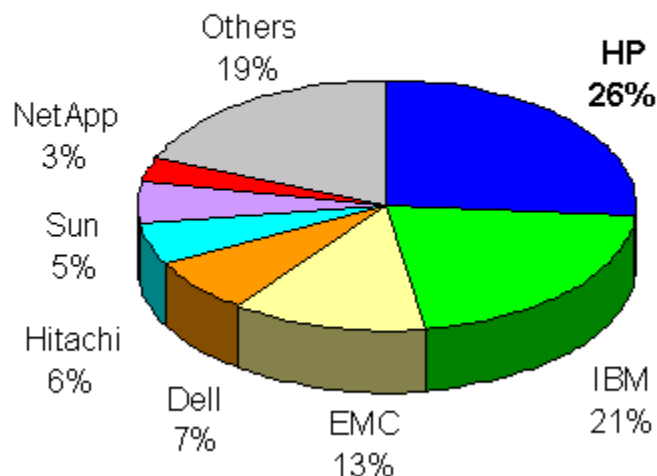
WW Open SAN Market Share
(Revenue), 3Q03



Disk storage market share

With \$1.3B of sales in the third quarter of 2003, HP remains the #1 storage vendor with 26.4% share in the total disk storage market.

WW Disk Storage Market Systems
Revenue Market Share, 3Q03

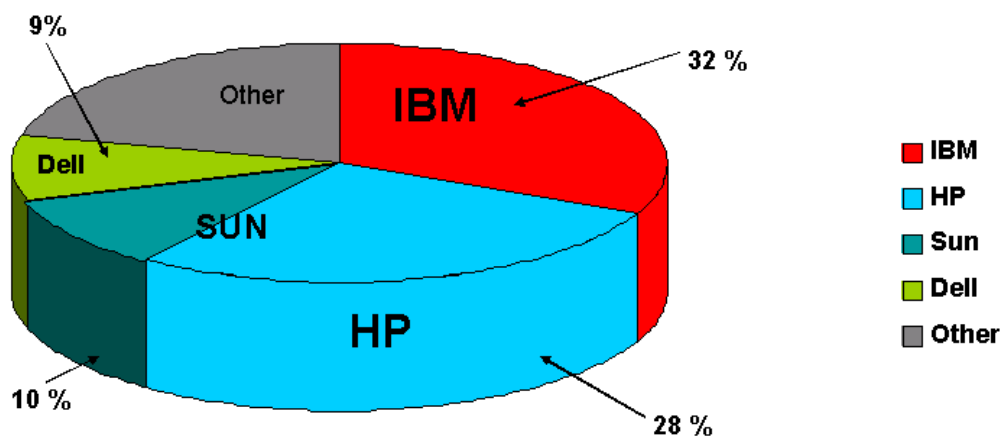


Storage market trends

- Networked storage will become the dominant form of disk storage.
- Top three drivers of new investments in storage are:
 - Data growth
 - Data security
 - Higher availability
- For many, if not most, companies in this time of reduced business spending, the critical challenge continues to be to “do more with less.”
- When it comes to selecting a vendor, the leading factors are:
 - Features and benefits of the products and services the vendor offers
 - Whether the vendor is seen as “strategic” in its ability to supply other technology
- Tape still dominates the market.
 - Tape investments are on the rise.
 - Disaster recovery investments are on the rise.

Server market share

HP sales and partners can leverage new server sales from the installed server base to increase storage sales. Perhaps you already have a “storage” opening in many accounts without realizing it.



\$10.8 billion revenues

IDC, December 2003

Enterprise business requirements

There are as many opportunities for enterprise storage solutions as there are enterprise customers. The most common SAN opportunities are:

- Explosive data growth
- Server and storage consolidation
- Multiple operating system support
- Reduced storage management complexity
- High availability
- Improved backup and restore efficiency
- Business continuance/disaster tolerance
- SAN optimization

Before offering specific enterprise storage solutions, salespeople must listen to customer requirements in these areas. Only then can a salesperson offer a business and technical solution that a C-level executive can understand and endorse.

Customer requirement: explosive data growth

Look for

- Customers who need to respond to market and organizational changes quicklyFaster application deployment
 - Timely responsiveness to competitive developments
 - Limited downtime capability
 - Requirement to maintain user productivity and access to data
- Companies with the following characteristics:
 - High-growth industries — biotech, medical
 - Data-intensive applications — business intelligence, e-commerce, CRM, information archives
 - Other vertical markets — entertainment, media

How do SANs add business value?

- Storage or servers can be added easily to accommodate growth without disruption
- Better uptime can translate into higher revenues, and improved customer satisfaction
- Better responsiveness to meet storage needs can also translate into improved business flexibility, and better overall company performance

Customer requirement: storage and server consolidation

This is a key opportunity for businesses at the early stage of the SAN life cycle. Customers who physically consolidate storage in a single enclosure, or logically consolidate with a SAN, can more efficiently configure, manage, and maintain storage resources.

Look for

- Companies with the following issues:
 - Undergoing server consolidation
 - Underutilized primary storage disks
 - High number of dedicated tape drives
 - Expensive management resources or inadequate staffing
 - Poor application performance/slow file access
- Companies with the following characteristics:
 - Three or more servers, or more than 100GB of storage
 - Distributed storage systems
 - Management or resource consolidation
 - Vertical industries: banks, financial institutions, medical, utilities, entertainment, telecommunications

How do SANs add business value?

- Operational savings because of lower storage management costs, better storage utilization, and lower backup costs
- Lower total cost of ownership (TCO): Management centralization and simplification, increased data availability and ease of growth
- Better business flexibility because storage or servers can be added easily and without disruption to accommodate growth
- Service level improvements due to improved availability

Customer requirement: multiple operating system support

Look for companies with the following profile:

- Decentralized and distributed business applications
- Islands of data, unable to share data with various systems
- Heterogeneous server operating system environment:
 - Windows NT
 - Windows 2000
 - NetWare
 - UNIX (HP-UX, AIX, Solaris, Tru64 UNIX)
 - OpenVMS
 - Linux
 - Others

How do SANs add business value?

- Improve utilization by sharing storage among servers running different operating systems
- Improve business flexibility and time-to-market due to improved data access
- Lower backup costs

Customer requirement: reduced storage management complexity

Look for companies with the following needs:

- Looking to reduce storage management costs
- Have a lack of skilled storage administrative resources

How do SANs add business value?

- Storage management software allows fewer administrators to remotely monitor and manage more distributed storage
- Storage management software increases automation
- Storage management software decreases configuration activities

Customer requirement: high availability

Look for companies with businesses or applications that must sustain a 24x7 operation, and have high costs associated with downtime:

- E-commerce
- On-line transaction processing — OLTP (insurance, reservation systems)
- Financial (exchanges, trading)
- Service providers
- Telecommunications

How do SANs add business value?

- For these businesses, downtime translates to revenue loss either directly, as in the case of stock exchanges or financial trading businesses, or indirectly by decreased service levels that can be offered by service providers.
- High-availability software solutions can provide redundant pathing to servers and storage. This keeps hardware, network, and applications functional in case any one element fails. High-availability customers may also need business continuance solutions.

How available is available?	
Availability percentage	Annual unplanned downtime
99	88 hours
99.5	44 hours
99.9	8.8 hours
99.95	4 hours
99.99	53 minutes
99.999	5.3 minutes
99.9999	3.2 seconds

Customer requirement: improved backup and restore efficiency

Look for companies with the following characteristics:

- Have purchased Windows NT disks, RAID systems, backup software, tape drives and libraries, and servers
- Have 50GB–2TB of storage per server
- Have few skilled, in-house IT management resources
- Have rapidly growing volumes of data, either direct-attached or on a SAN, that are increasingly difficult and time-consuming to back up
- Have users complaining of slow system performance during backups

How do SANs add business value?

- SANs and the Enterprise Backup Solution provide faster backups, and more efficient use of storage assets, with heterogeneous servers sharing the same tape library and backup scheduling being done from a single server.
- Benefits include:
 - Enhanced IT availability
 - Predictability
 - Investment protection
- From a business value perspective, better availability can result in better user application performance, the ability to support more users, or improved service levels.

Customer requirement: business continuance/disaster tolerance

Look for

- Companies who need to recover from a disaster within seconds or minutes, as opposed to days or weeks
- Companies who determine that the cost of extended downtime and risk of potential data loss outweigh the cost of duplicate systems and supporting infrastructure
- Industries requiring business continuance under any conditions:
 - Telecommunications and media
 - Financial and banking
 - Manufacturing
 - Utilities
 - Government

How do SANs add business value?

- SANs configured for disaster tolerance can restore business operations in minutes
- For many companies, a disaster-tolerant solution can mean the difference between business failure and survival

Customer requirement: SAN optimization

For customers who have migrated to storage area networks, the challenge is how best to optimize their networked storage. Customers need to consolidate storage in a virtual pool that allows them to utilize storage more efficiently across the enterprise, as well as manage and maintain their storage resources.

Look for companies who need to dramatically improve the efficiency of their SAN infrastructure:

- Increased storage utilization
- Dramatically simplified RAID storage administration and configuration
- Sizable performance improvements
- Instantaneous restore times

How does virtualization add business value?

- Customers can improve operational efficiencies by optimizing their use of storage capacity and simplifying RAID administration.
- Traditional storage architectures, including some SAN architectures, allow customers to utilize 50% or less of the storage they purchase because capacity is reserved for snapshots of their databases or datasets. Virtualization frees customers from this constraint, effectively doubling storage capacity, and makes RAID configuration easier so less IT support is required.
- Virtualization also provides value by improving uptime and reducing access times.

Summary

- The overall market for storage products is expected to show continued growth
- HP SANs deliver business value by lowering IT costs, increasing revenue opportunities, and providing greater business flexibility
- The top three drivers for new investments in storage are:
 - Data growth
 - Data security
 - Higher availability
- SAN opportunities include:
 - Storage and server consolidation
 - Multiple operating system support
 - Reduced management complexity
 - High availability
 - Increased backup and restore efficiency
 - Business continuance/ disaster tolerance
 - Explosive data growth
 - SAN optimization

Learning check

1. Which of the following is **not** a current trend in the storage market?
 - a. Brand recognition will be a critical factor in the selection of storage vendors.
 - b. The overall trend in storage is toward direct attached storage solutions.
 - c. A key challenge for IT departments will continue to be “to do more with less.”
 - d. There is skepticism in investing in new technologies and, therefore, a conservative approach to investing in new solutions.
2. Based on the information in this module, which of the following companies holds the number two position in the disk storage systems market?
 - a. Dell
 - b. EMC
 - c. IBM
 - d. HP
3. Based on the information in this module, which of the following is **not** an industry in which you would look for customers who have the requirement for high availability?
 - a. Publishing
 - b. Finance
 - c. E-commerce
 - d. Telecommunications

Enterprise storage business value sales model

Module 2

Objectives

After completing this module, students should be able to:

- Define business value.
- Define value selling.
- Explain why business value is important.
- Define three contributors to storage business value in the HP business value methodology.
- Explain why the HP business value model software is a business value selling tool.

How do you define business value?

Describe what business value means:

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.....

Business value defined

$$\text{Profits} = \text{Revenue} - \text{Expenses}$$

Business value consists of creating additional profits for customers by influencing the components of this equation—either from the growth of revenues, a reduction in expenses, or both.

Value selling defined

Value selling is the process of helping customers connect IT to their business and measuring the improvement in business value as they change IT strategies. This process leads to a much stronger customer relationship and, ultimately, to increased sales.

Why business value?

IT investments are increasingly being linked to business performance. Why?

- IT has become a significant part of corporate spending
 - About 5% of revenue¹ for the average enterprise
 - Big IT budgets require executive-level decisions and approval
 - Executives focus on revenue and profitability
- Increased corporate focus is on IT returns
- Decision-makers need to:
 - Understand the impact of IT investments on their business
 - Rationalize IT investments relative to other strategic investments (such as R&D, plant, and equipment)
 - Evaluate the financial case for investing in new technology
- Thus, storage salespeople can become business consultants

IT is driving business value

“The newest innovations, which we label information technologies, have begun to alter the manner in which we do business and create value, often in ways not readily foreseeable even five years ago.”

Alan Greenspan
Chairman, United States Federal Reserve

¹ Gartner Group, March 2002.

The role of IT is changing

“[Today] 40 percent of senior IT managers will have to communicate their IT strategies to business managers and planners in terms of IT business value potentials with related strategic planning assumptions and estimates, or risk being supplanted in the business management process. By 2005, 75 percent of IT senior managers will be affected by these requirements.”

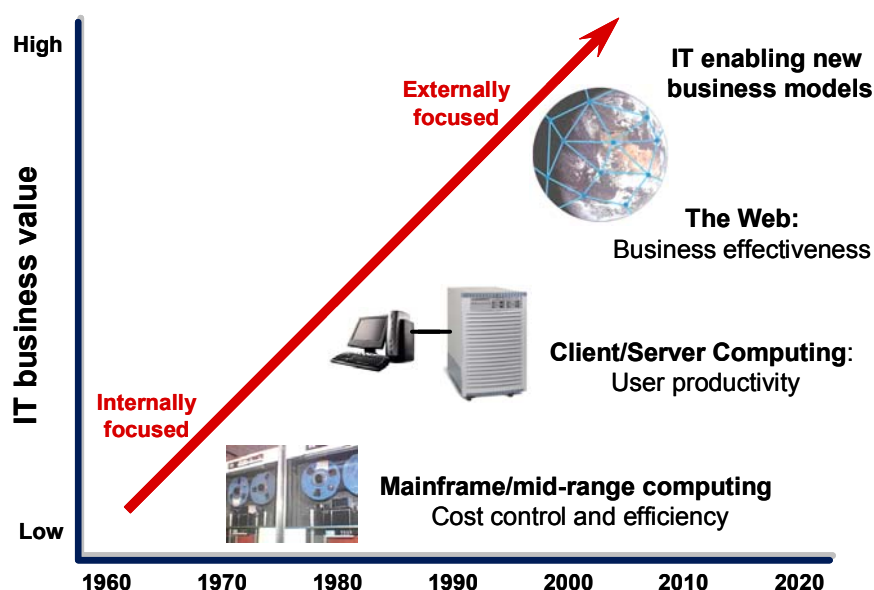
Source: Gartner Group

It is clear that senior IT managers must learn to communicate in the language of business if they are to remain successful. This means that salespeople who communicate in business value terms can help these senior IT managers communicate to other functional groups.

Evolution of IT business value

The role of IT has shifted from the 1970s and 1980s where organizations were concerned with automating business processes such as payroll and improving the productivity of office workers through word processing programs. More recently, IT programs have focused on improving business effectiveness using the Web, changing the way companies conduct business with suppliers and customers. IT has also enabled entirely new business models such as on-line auctions (eBay), electronic healthcare transaction processing (WebMD), and e-mail direct marketing (Digital Impact).

IT business value increases as the organization moves from being internally focused to being externally focused, and as IT programs evolve from cost control and automation to the adoption of new business paradigms.



Business executive priorities

Business executives such as CIOs, CFOs, and CEOs, and their senior managers, play a key role in the decision-making process for IT investments, either by setting the business goals that drive projects, by exercising final approval of the projects, or sometimes by participating on the team that specifies the IT requirements.

These senior managers are the primary target for your value selling efforts.

Senior managers are concerned with longer-term, strategic issues for the business, such as potential sources of revenue three to five years out, and finding ways to improve competitiveness through operational efficiencies, time-to-market, and customer retention. IT is a critical tool to help these executives achieve their objectives.

Business executive priorities include:

- Using IT to create new business opportunities that directly impact revenue and profit:
 - Developing new products, markets, or businesses
- Improving business productivity:
 - Reducing cycle times, improving operational efficiency
 - Increasing customer satisfaction and loyalty, lowering cost of sales
- Increasing IT operational efficiency to lower costs

Business executive IT concerns

When considering IT investments, business executives want to quantify the costs and benefits of any potential investments, and understand how the investment can help the business achieve its strategic objectives. In order to understand the true benefits of any investment, the investment needs to be tied to business results.

- What is the real dollar impact of any proposed spending?
- When will the business get a payback from an IT investment?
- What is the business impact of moving applications to a new architecture?
- How will changes in infrastructure affect overall business value?
- Can I reduce downtime costs with a change in IT infrastructure?
- How will an investment improve my competitive position?
- Of all of the potential investments, which one has the “biggest bang for the buck”?

The problem with traditional selling

- Traditional focus on selling features
- Inadequate understanding of the customer's business
- Failure to communicate the business impact of IT solutions
- Transactional relationships
- Access to IT but not to business managers

Selling features and performance to IT professionals and development people works fine. However, it's not enough for enterprise selling. As a supplier of enterprise technology infrastructure, it is necessary to understand how the infrastructure is an enabler of business functions and objectives.

What needs to change?

- **Relationship building** — Learn with the customer, collaborate long-term, and build a partnership
- **Better knowledge about the customer** — Understand the customer's business, key objectives, critical success factors, and key metrics
- **Linking IT to the lines of business** — Determine how IT can help customers meet their business objectives
- **Communication** — Communicate in terms that senior managers understand — in business terms.

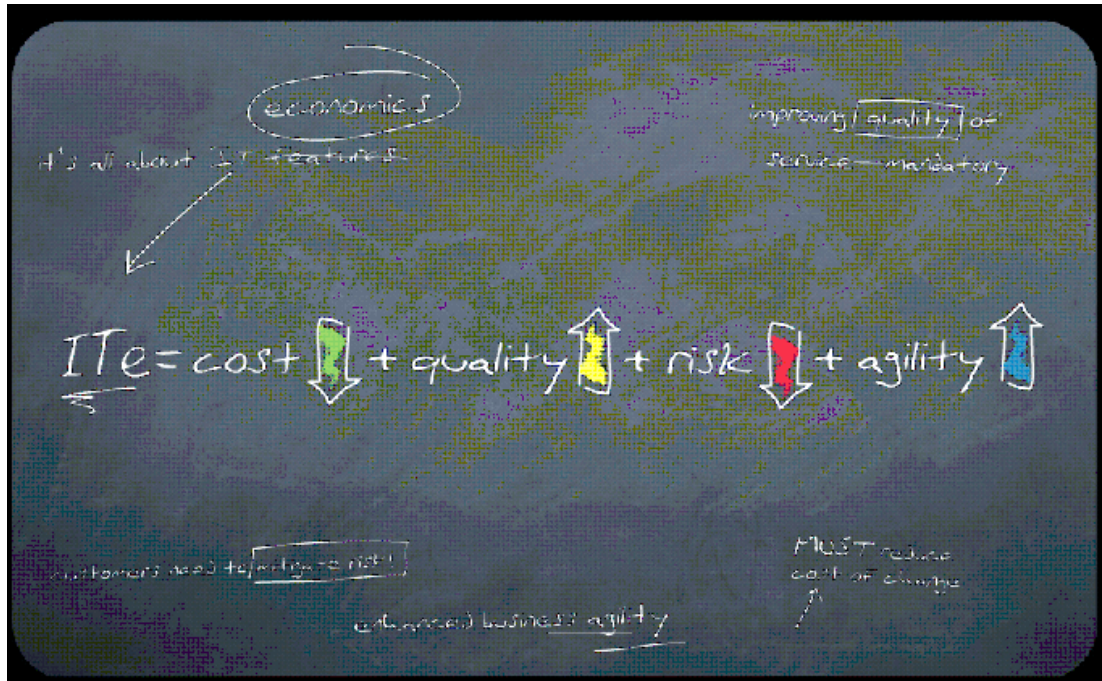
Value selling should be an integral part of every enterprise sales process. Value selling touches on almost every stage of this sales process. To support value selling, salespeople must:

- Know their customers' businesses — what they do, their customers, their competition, and the core components of their operations.
- Understand business initiatives that are critical to their customers' long-term success.
- Be able to use business language rather than technical specifications.

Appendix A contains a description of the various activities that HP salespeople (direct and reseller) perform in conducting a storage sale.

Focus on IT economics

Today it is clear that the focus is no longer on the features of an IT solution...the focus is on the economics. An HP customer actually drew the following equation for HP. In its simplicity, it captures what HP is all about: reduced costs, increased quality, reduced risk, and increased agility—the right economics business-driven IT.



Characteristics of effective business value propositions

A business value proposition translates solution benefits to business value terms that customers understand and feel are important. So what are the key elements of a business value proposition?

An effective value proposition must be:

- Applicable to distinct constituencies, and have an influence on things that are important to that constituency
 - **CEO** — Is interested in solutions that develop competitive business advantage and/or create new business opportunities
 - **CIO** — Is concerned with lowering IT operating costs and reducing application development backlog
 - **CFO** — May invest in solutions that lower costs or reduce risk
 - **Clients/users** — Would like to see improved service levels or greater service level consistency
- Simple, tangible, and easy to understand:
 - Clear translation into monetary terms
 - Long-term investment protection
 - Unique business benefits

HP storage business value methodology

$$\begin{array}{ccccccc} \text{Business} & = & \text{Operational} & + & \text{Improved} & + & \text{Improved} \\ \text{value} & & \text{efficiencies} & & \text{service levels} & & \text{business flexibility} \\ & & \text{Cost} & & \text{Increased} & & \text{Increased} \\ & & \text{reduction} & & \text{revenue} & & \text{revenue} \end{array}$$

In the HP storage business value methodology, business value is equal to the sum of each of the following: improved operational efficiencies, improved service levels, and improved business flexibility.

The HP business value methodology goes beyond just simple cost of ownership or return on investment (ROI) analysis. It captures both “hard” (cost savings) and “soft” (revenue-related) dollars generated by storage investments.

Defining storage business value

Storage business value consists of maximizing business profits by implementing various storage strategies. The increase in profits can be achieved either by increases in revenue, decreases in costs, or both.

There are three contributors to business value in a storage context: **operational efficiencies**, **service levels**, and **business flexibility**. Each of these contributors has a direct influence on company revenues or costs, and each can be further characterized by specific sub-elements such as staff costs, user productivity, availability, application deployment, and so forth.

Operational efficiencies (operating costs)

- Hardware, software, and network
- Staff utilization
- Server utilization
- Storage utilization
- Backup costs
- Asset management
- Network costs



Service levels

- Availability
- Performance
- Number of customers
- Number of users
- Application value
- Impact of downtime

Business flexibility

- | | |
|------------------------------|------------------------|
| • Time to market | • Speed of data access |
| • Application deployment | • Cycle time |
| • Rate of application change | • Revenue impacts |
| • Application value | • Responsiveness |

A storage area network (SAN) implementation is one storage strategy that generates business value for customers by influencing operational costs, service levels, and business flexibility.

Value selling in storage terms

In storage terms, value selling consists of:

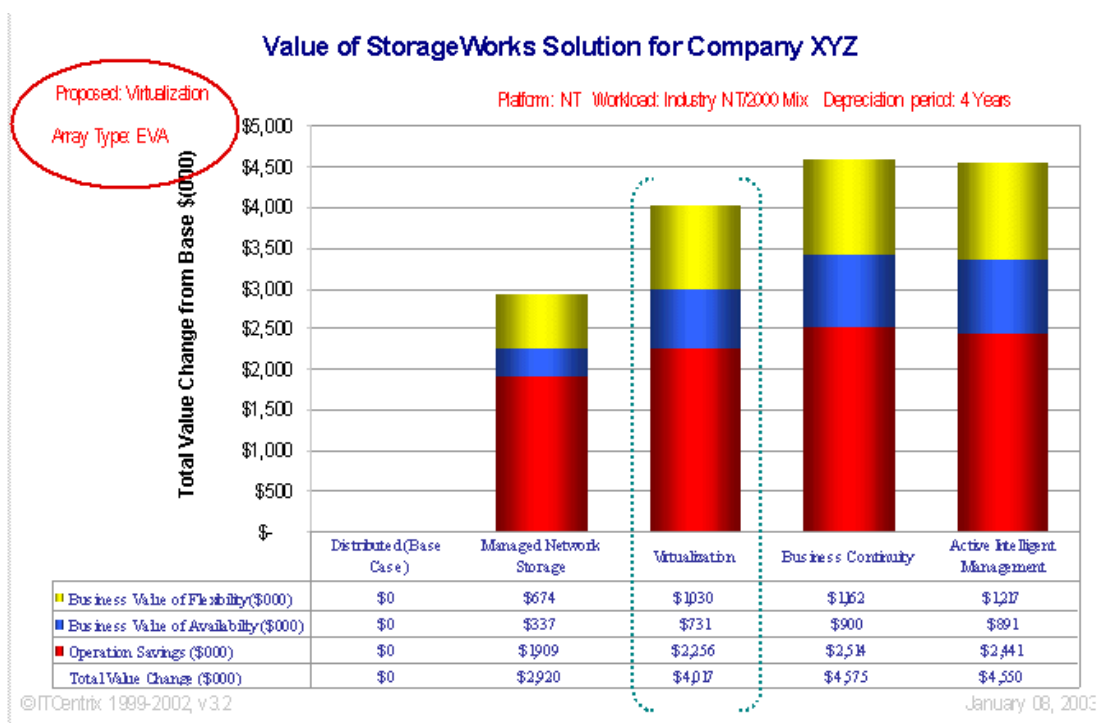
- **Connecting** storage to the customer's business
- **Communicating** in business terms such as operational efficiencies, service levels, and business flexibility
- **Quantifying** business value as the customer adopts a storage strategy to support business goals

HP Business Value Model software

- Developed by ITCentrix
 - Independent company that develops business value models
 - Model based on actual customer data
- How does the model work?
 - Calibrates data from hundreds of Global 2000 corporations
 - Uses a tested methodology combining cost, technology, and business modeling
 - Analyzes customer inputs and quantifies business value based on customer's actual IT environment
 - Predicts how changes in storage architectures will impact business results

Quantifying storage business value

The following chart demonstrates how the business value of storage can actually be quantified using the HP Business Value Model Software tool. This software is included in the *Selling the Business Value of HP Storage Solutions* course.



Summary

To sell enterprise storage effectively, you must

- **Connect** enterprise storage value to customer business and IT strategies.
- **Focus** selling efforts on key storage decision-makers.
 - Business executives
 - Senior IT managers
- Sell value by **communicating** in terms such as
 - Operational efficiencies
 - Service levels
 - Business flexibility
- **Quantify** business value using the HP Business Value Software tool.

Learning check

1. Business value creates additional profits for customers by influencing which of the following?
 - a. Automation of business processes
 - b. Productivity of office workers
 - c. Growth of revenues and reduction of expenses
 - d. Internal business focus
2. Value selling is the process of helping customers connect IT to their _____ and measuring the improvement in business value as they change IT strategies.
 - a. Business
 - b. Accounting systems
 - c. IT staff
 - d. Networks
3. What do salespeople need to change in their approach in order to be perceived as value sellers versus traditional sellers?
 - a. Relationship building, better customer knowledge, communication in terms that senior managers understand
 - b. Learning with the customer, collaborating long-term, and building transactional relationships
 - c. Understanding the customer's business, key objectives, critical success factors, and key metrics
 - d. Communicating in terms senior managers understand, i.e., business terms.
4. *Application value, number of users, and availability* are characteristics of which of the following contributors within the business value methodology?
 - a. Business flexibility
 - b. Service levels
 - c. Operational efficiencies
 - d. Rate of application change

5. Which **two** of the following statements are **true** concerning the HP Business Value Model software?
- a. The software was developed by HP.
 - b. The software uses a tested methodology combining cost, technology, and business modeling.
 - c. The software predicts how changes in storage architectures will impact business results.
 - d. The software is based on hypothetical lab data.

HP enterprise storage solutions opportunity worksheet

Module 3

Objectives

At the end of this module, students should be able to:

- List information about a customer opportunity for selling enterprise level storage solutions.
- Identify information needed to complete understanding of the customer opportunity.
- Develop the questions and the strategy to use to get the information needed.
- List the action items to address after the *Selling HP Enterprise Storage Solutions* course is completed to develop a relationship with the customer and obtain the customer's commitment for the purchase of HP enterprise storage solutions.

Instructions

Over the course of the next 2 days, you will have the opportunity to learn more about the solutions that HP has available to address the storage needs of its Enterprise customers. At the same time, you will have the chance to plan your own strategy for using the information you gain from this session to enhance the work you are doing with one of your current customers.

At several stages throughout the program, you will use the resources contained in this package to:

- Assess your current knowledge of your customer
- Map what you know of your customer's needs to the storage opportunities that exist in the enterprise market
- Identify the information you still require to gain your customer's commitment to purchase the HP enterprise storage solutions
- Identify the steps you will follow to gain your customer's commitment to purchase the HP enterprise storage solutions

Security and privacy

As you work on the Opportunity Worksheets, please be sensitive to the fact that mixed student audiences are present. For example, competitive channel partners may be in the same class and they could possibly be competing for the same account opportunities.

The Opportunity Worksheet is designed to allow for classroom interaction. To avoid disclosing specific account information, rather than identifying an account by its proper name, please use generic industry identifiers such as "large retailer," or "manufacturer."

Part 1:

HP enterprise storage solutions opportunity worksheet

Instructions: Think of a current customer opportunity you have for the sale of enterprise storage solutions. Then use the following sections of the HP Enterprise Storage Solutions Opportunity Worksheet to list the information that you currently have about this opportunity.

<i>Customer Name:</i>	<i>Customer Industry:</i>
<i>Account Status:</i> <input type="checkbox"/> <i>Current HP StorageWorks customer</i> <input type="checkbox"/> <i>Current HP server customer</i> <input type="checkbox"/> <i>Competitive storage customer</i> <input type="checkbox"/> <i>Competitive server customer</i>	<i>HP StorageWorks Opportunity Timeframe:</i> <input type="checkbox"/> <i>Immediate</i> <input type="checkbox"/> <i>This month</i> <input type="checkbox"/> <i>This quarter</i> <input type="checkbox"/> <i>This year</i>
<i>Critical Business Challenges:</i>	<i>Critical Technical Challenges:</i>
<i>Storage Purchase/Lease Decision Makers: (Name & Title, Approval Level)</i> <input type="checkbox"/> <i>\$50K – \$100K</i> _____ <input type="checkbox"/> <i>\$100K – \$250K</i> _____ <input type="checkbox"/> <i>\$250 – \$500K</i> _____ <input type="checkbox"/> <i>\$500k – \$1M</i> _____ <input type="checkbox"/> <i>\$1M+</i> _____	<i>Competitive Challenges/Influences:</i>
<i>Storage Opportunities:</i> <input type="checkbox"/> <i>Explosive Data Growth</i> <input type="checkbox"/> <i>Storage and Server Consolidation</i> <input type="checkbox"/> <i>Multiple Operating System Support</i> <input type="checkbox"/> <i>Reduced Storage Management Complexity</i> <input type="checkbox"/> <i>High Availability</i> <input type="checkbox"/> <i>Improved Backup and Restore Efficiency</i> <input type="checkbox"/> <i>Business Continuity/Disaster Tolerance</i> <input type="checkbox"/> <i>SAN Optimization</i> <input type="checkbox"/> <i>Other:</i>	<i>CIO Issues:</i> <input type="checkbox"/> <i>Explosive Data Growth</i> <input type="checkbox"/> <i>Cutting/Stabilizing Costs</i> <input type="checkbox"/> <i>Aligning IT Investments with Business Directions</i> <input type="checkbox"/> <i>Building Strong IT Service Delivery</i> <input type="checkbox"/> <i>Selective Outsourcing</i> <input type="checkbox"/> <i>Resource Management</i> <input type="checkbox"/> <i>Security in All its Aspects</i> <input type="checkbox"/> <i>Enterprise Architecture</i> <input type="checkbox"/> <i>Systems Integration</i> <input type="checkbox"/> <i>Building Credibility for the Value of IT Services</i> <input type="checkbox"/> <i>Planning: Prioritizing IT Investments</i> <input type="checkbox"/> <i>Other:</i>

<i>Customer Name:</i>	<i>Customer Industry:</i>
<i>Computing Environments (Quantity, Suppliers, Operating Systems):</i> <ul style="list-style-type: none"> <input type="checkbox"/> Mainframes/OS <input type="checkbox"/> Servers/Application <input type="checkbox"/> Servers/Application <input type="checkbox"/> Desktops/Application <input type="checkbox"/> Desktops/Application 	<i>Key Customer Value Propositions for Potential Enterprise Solutions and Services:</i>
<i>Key Storage Strategy Issues:</i> <ul style="list-style-type: none"> <input type="checkbox"/> DAS – Direct connect/server attached storage <input type="checkbox"/> NAS – Network Attached Storage <input type="checkbox"/> SAN – Storage Area Networks <input type="checkbox"/> Software Management <input type="checkbox"/> Backup <input type="checkbox"/> Archiving <input type="checkbox"/> Media Management <input type="checkbox"/> Storage services <input type="checkbox"/> Other storage strategy issues: 	



Please do not continue on to the next section until you receive further instructions.

Part 2 (day 1 homework): HP enterprise storage solutions opportunity worksheet

Instructions: Review the information you have compiled about your customer opportunity in Part 1, above. Take the time to transfer your notes to the complete copy of the Opportunity Worksheet that follows. As you transfer your notes, think again about what you know about your customer and make any additions or changes you think are necessary. Then, using the information from the first day of the program, complete the remainder of the Opportunity Worksheet and move on to the Account Planner that follows it.

<i>Customer Name:</i>	<i>Customer Industry:</i>
<i>Account Status:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>Current HP StorageWorks customer</i> <input type="checkbox"/> <i>Current HP server customer</i> <input type="checkbox"/> <i>Competitive storage customer</i> <input type="checkbox"/> <i>Competitive server customer</i> 	<i>HP StorageWorks Opportunity Timeframe:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>Immediate</i> <input type="checkbox"/> <i>This month</i> <input type="checkbox"/> <i>This quarter</i> <input type="checkbox"/> <i>This year</i>
<i>Critical Business Challenges:</i>	<i>Critical Technical Challenges:</i>
<i>Storage Purchase/Lease Decision Makers: (Name & Title, Approval Level)</i> <ul style="list-style-type: none"> <input type="checkbox"/> \$50K – \$100K _____ <input type="checkbox"/> \$100K – \$250K _____ <input type="checkbox"/> \$250 – \$500K _____ <input type="checkbox"/> \$500k – \$1M _____ <input type="checkbox"/> \$1M+ _____ 	<i>Competitive Challenges/Influences:</i>
<i>Storage Opportunities:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>Explosive Data Growth</i> <input type="checkbox"/> <i>Storage and Server Consolidation</i> <input type="checkbox"/> <i>Multiple Operating System Support</i> <input type="checkbox"/> <i>Reduced Storage Management Complexity</i> <input type="checkbox"/> <i>High Availability</i> <input type="checkbox"/> <i>Improved Backup and Restore Efficiency</i> <input type="checkbox"/> <i>Business Continuity/Disaster Tolerance</i> <input type="checkbox"/> <i>SAN Optimization</i> <input type="checkbox"/> <i>Other:</i> 	<i>CIO Issues:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>Explosive Data Growth</i> <input type="checkbox"/> <i>Cutting/Stabilizing Costs</i> <input type="checkbox"/> <i>Aligning IT Investments with Business Directions</i> <input type="checkbox"/> <i>Building Strong IT Service Delivery</i> <input type="checkbox"/> <i>Selective Outsourcing</i> <input type="checkbox"/> <i>Resource Management</i> <input type="checkbox"/> <i>Security in All its Aspects</i> <input type="checkbox"/> <i>Enterprise Architecture</i> <input type="checkbox"/> <i>Systems Integration</i> <input type="checkbox"/> <i>Building Credibility for the Value of IT Services</i> <input type="checkbox"/> <i>Planning: Prioritizing IT Investments</i> <input type="checkbox"/> <i>Other:</i>
<i>Computing Environments (Quantity, Suppliers, Operating Systems):</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>Mainframes/OS</i> <input type="checkbox"/> <i>Servers/Application</i> <input type="checkbox"/> <i>Servers/Application</i> <input type="checkbox"/> <i>Desktops/Application</i> <input type="checkbox"/> <i>Desktops/Application</i> 	

<i>Customer Name:</i>		<i>Customer Industry:</i>	
<i>Key Storage Strategy Issues:</i> <ul style="list-style-type: none"> <input type="checkbox"/> DAS – Direct connect/server attached storage <input type="checkbox"/> NAS – Network Attached Storage <input type="checkbox"/> SAN – Storage Area Networks <input type="checkbox"/> Software Management <input type="checkbox"/> Backup <input type="checkbox"/> Archiving <input type="checkbox"/> Media Management <input type="checkbox"/> Storage services <input type="checkbox"/> Other storage strategy issues: 		<i>Potential Enterprise Storage Solutions:</i> <ul style="list-style-type: none"> <input type="checkbox"/> HP StorageWorks XP <input type="checkbox"/> HP StorageWorks EVA <input type="checkbox"/> HP OpenView CASA <input type="checkbox"/> HP StorageWorks Virtual Array <input type="checkbox"/> HP StorageWorks NAS Solutions <input type="checkbox"/> HP StorageWorks Tape Libraries <input type="checkbox"/> HP Archival Systems <input type="checkbox"/> HP StorageWorks SAN Interconnects <input type="checkbox"/> HP OpenView SAM <input type="checkbox"/> HP OpenView Storage Data Protector <input type="checkbox"/> Third-Party Enterprise Backup Solution <input type="checkbox"/> HP OpenView Storage Media Operations <input type="checkbox"/> Enterprise Storage Services (see below) <input type="checkbox"/> Leasing 	
<i>Key Customer Value Propositions for Potential Enterprise Solutions and Services:</i>		<i>Potential Enterprise Storage Services:</i> <ul style="list-style-type: none"> <input type="checkbox"/> SAN Solution Service <input type="checkbox"/> Backup and Recovery Solution Service <input type="checkbox"/> Data Migration Services <input type="checkbox"/> Data replication solution services <input type="checkbox"/> Disaster Tolerant Management Service <input type="checkbox"/> Storage virtualization solution services <input type="checkbox"/> Hardware/Software Implementation Service <input type="checkbox"/> HP Care Packs <input type="checkbox"/> SAN Environment Support <input type="checkbox"/> Critical Service for SAN <input type="checkbox"/> Business Continuity Services <input type="checkbox"/> Mission Critical Support (Proactive 24) for XP and EVA <input type="checkbox"/> Instant Support Enterprise Edition <input type="checkbox"/> Hardware Support 	
<i>Action Steps:</i> <ul style="list-style-type: none"> <input type="checkbox"/> ENSAextended Update _____ <input type="checkbox"/> VersaStor Update _____ <input type="checkbox"/> HP StorageWorks Update _____ <input type="checkbox"/> HP OpenView SAM Update _____ <input type="checkbox"/> Proposal _____ <input type="checkbox"/> Business Value Model Report _____ <input type="checkbox"/> Other _____ 	<i>Date:</i>	<i>StorageWorks Resources Required</i> <ul style="list-style-type: none"> <input type="checkbox"/> Storage Sales Specialists _____ <input type="checkbox"/> Storage Architect _____ <input type="checkbox"/> Storage Systems Engineer _____ <input type="checkbox"/> StorageWorks Competitive Team _____ <input type="checkbox"/> Storage Call Center _____ <input type="checkbox"/> Storage Events and Training _____ <input type="checkbox"/> Storage Services Sales Specialist _____ 	<i>Date:</i>

Account planner

Instructions: Review the information you have compiled so far about your customer in the Opportunity Worksheet. Then think about what you know and compare it to what you believe you need to know in order to:

- Accurately assess your customer's needs
- Articulate the solutions you would propose to meet those needs
- Gain the commitment of decision makers and interested parties for your proposed solution
- Make the financial arguments necessary to justify the purchase of your proposed solution

Account planner – part 1

INFORMATION YOU NEED TO OBTAIN	
TECHNICAL	
DECISION MAKERS	
INFLUENCERS	
FINANCIAL	
COMPETITIVE	
BUSINESS CHALLENGES	
SUCCESS CRITERIA	
OTHER?	

Account planner – part 2

ACTION STEPS – HOW WILL YOU OBTAIN THIS INFORMATION?	
TECHNICAL	
Questions to ask:	Steps to take:
DECISION MAKERS	
Questions to ask:	Steps to take:
INFLUENCERS	
Questions to ask:	Steps to take:
FINANCIAL	
Questions to ask:	Steps to take:
COMPETITIVE	
Questions to ask:	Steps to take:
BUSINESS CHALLENGES	
Questions to ask:	Steps to take:
SUCCESS CRITERIA	
Questions to ask:	Steps to take:



*Please do not continue on to the next section
until you receive further instructions.*

Part 3:

Action plan

Instructions: Review the work you have done in compiling information about your customer opportunity in the HP Enterprise Storage Solutions Opportunity Worksheet and in the Account Planner. Take a close look at the information you have listed in the Account Planner that you still need to obtain and the action steps you've listed to obtain it. Make any additions or modifications you think are necessary based on:

- What you have learned in the 2 days of the Selling Enterprise Storage Solutions program
- Discussions with your fellow participants
- Any further reflections you have

Use the following form to list the top five actions you will take following the completion of the Selling Enterprise Storage Solutions program to further develop your relationship with your customer and to obtain your customer's commitment to purchase HP storage solutions.

Action plan

ACTION #1 – TOP PRIORITY	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
ACTION #2 – TOP PRIORITY	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
ACTION #3 – HIGH PRIORITY	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
ACTION #4 – HIGH PRIORITY	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
ACTION #5 – HIGH PRIORITY	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	

Enterprise vision, mission, and strategy

Module 4

Objectives

After completing this module, students should be able to:

- Describe the HP corporate strategy and value proposition.
- Describe the HP Adaptive Enterprise vision.
- Articulate the positioning of ENSAextended within the Adaptive Enterprise vision.
- Describe the HP storage vision.
- Define HP Information Lifecycle Management and the three customer challenges it addresses.
- Describe the HP StorageWorks Reference Information System and list the benefits it provides to customers.

HP corporate strategy

The HP corporate strategy is: “Reliable innovation at a price our customers can afford, delivered with an experience that sets us apart.” The HP strategy is to be the leading technology company in the world, commanding the largest market share and exerting the greatest influence in each of the markets it serves. To achieve that goal requires an unwavering focus on strategy and a commitment to delivering more of what customers want. The HP strategy is to offer a portfolio of products, services, and solutions that are high tech, low cost, and deliver the best customer experience.

Execution of the strategy can be seen in these results:

- Over 665 new products introduced in FY03.
- 11 patents generated per day
- Example: \$1.2 billion saved against a \$1 billion supply chain process savings goal
- \$600 million invested in branding
- “+hp” – campaign of the year

HP corporate value proposition

“HP delivers more,” is the company’s basic value proposition, the lens through which it projects all of its capabilities into a total customer experience (TCE).

HP delivers more



HP delivers more. +hp = everything is possible.

Innovation at a price our customers can afford, delivered in a way that sets us apart.

Enterprise. Demand more.

CEO/CIO + HP. HP delivers more of what enterprise customers demand—more accountability, more agility and a better return on IT.

SMB. Get more.

Business owner + HP. HP allows business owners to get more by delivering—more reliability, more service and support, more local expertise—all at a competitive price.

Consumer. Enjoy more.

You + HP. HP allows you to enjoy more of life by delivering simple and rewarding technology experiences that are uniquely innovative, intuitive and empowering.

In a down economy and in an uncertain world, HP has established itself as a true global contender. HP is determined to become the undisputed #1 technology company in the world.

On the one hand is Dell, which offers a rapidly increasing number of customers reliable low-tech at a low price, with high customer satisfaction. On the other hand is IBM, which offers customers reliable high-tech at a high price, but with low customer satisfaction.

HP is ideally positioned between Dell and IBM. HP aims to deliver reliable high-tech at a competitive price, with high customer satisfaction for a total customer experience. Customers should not have to choose between innovation and price, functionality and simplicity, stability and agility, high cost and high customer satisfaction. HP is telling customers not to compromise, because with HP, they do not have to compromise.

Depending on the market sector that HP is targeting, HP articulates its value proposition slightly differently:

- To its enterprise customers, HP says “demand more” — more accountability, more agility, and a better return on IT.
- To small and medium businesses, HP says “get more” — more reliability, more service and support, more local expertise, and all at a competitive price.
- To consumers, HP says “enjoy more” — with the proposition that HP will deliver simpler, more intuitive, and more rewarding technology experiences that empower them to enjoy life — from digital photography to entertainment technology to a future we have yet to invent.

In short, HP is telling customers: demand more, get more, and enjoy more from HP.

The CIO’s balancing act

Today CIOs have several key challenges that are impacting their ability to keep up with the changing business environment. CIOs have to balance traditional IT requirements — to maximize return, mitigate risk and improve performance — with a new dimension of business agility, or being able to rapidly anticipate and respond to change.

Adaptive Enterprise

HP Adaptive Enterprise vision

The way to gain control of these challenges is with an Adaptive Enterprise. The HP vision is: Customers can be more competitive by evolving to an Adaptive Enterprise, which is defined as “business and IT synchronized to capitalize on change.”

What is an Adaptive Enterprise?

An Adaptive Enterprise is one in which business demand is constantly matched by IT supply. AE refers to the entire IT infrastructure made up of servers, storage, network connections, and so forth. Adaptive Enterprise creates:

- A shift from “vertical stack” oriented approaches to “horizontal infrastructure” approaches
- A common foundation that can run any application and business process
- An infrastructure driven by business strategy and business processes
- An environment where IT supply meets business demand
- An environment that drives the dynamic link between business processes and IT

Adaptive Enterprise design principles

To build a truly Adaptive Enterprise, customers need an IT architecture that supports the integration of business processes to allow an efficient flow of information across processes and between applications. This calls for a new kind of enterprise IT architecture—one that works horizontally instead of vertically, that links IT with the rest of the enterprise, that extends out to customers, partners and suppliers, and that is built on four fundamental design principles:

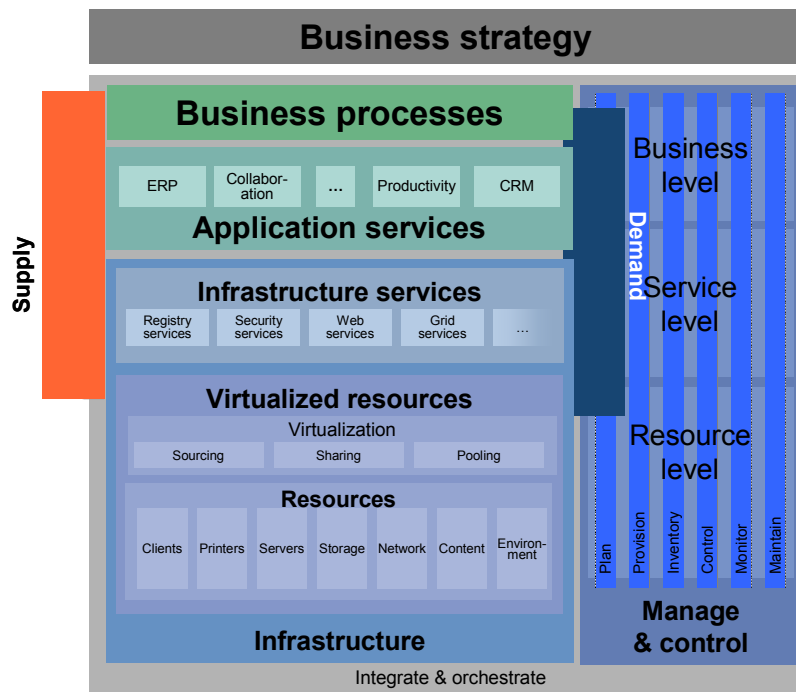
1. Simplify
 - Reduce complexities
 - Accelerate deployment
 - Streamline administration
2. Standardize
 - Create customer choice
 - Ensure investment protection
3. Modularize
 - Enhance scalability
 - Increase asset utilization
4. Integrate
 - Mitigate risk

The first of these principles—simplification—is for reduced complexity and risks. The second principle—standardization—is for increased flexibility through standards-based components and processes. The third—modularity—gives customers the ability to change, manage, virtualize, and use components, both collectively and independently. Customers should be getting the maximum utility out of every single IT asset. Surveys tell us that many customers use only 20 to 40 percent of their IT infrastructure. That utilization rate should be 80 percent or more.

And the fourth principle is integration of all components into a uniform system that is easy to manage, modify, and change. Web services technologies are particularly important here because they enable data integration, application, integration across the enterprise, or integration across an entire ecosystem with customers and partners.

Adaptive Enterprise Darwin Reference Architecture

HP Darwin Reference Architecture is the architectural blueprint for the Adaptive Enterprise. The Darwin Reference Architecture is a standards-based framework that leverages best-of-breed technology and components to create a new level of integration between business and IT. Darwin provides a framework for delivering information to business processes by way of applications.



The principal Darwin components are:

- **Business processes**—Business processes are the day-to-day functions that keep the business running (such as human resources, accounting, or supply-chain functions). The IT environment supports the business in meeting customer needs. The business processes collectively and continually set and adjust levels of IT resources to meet these changing demands. While the priorities for allocating resources to each business process are in constant flux, the supply of resources available to the business must always meet the demand. This is core to creating an Adaptive Enterprise.
- **Application services**—Applications acquire, organize, and transform the information needed to support business processes. Enterprise applications like SAP or PeopleSoft organize and deliver information across an enterprise; desktop applications serve local business processes the same way. In the Darwin Reference Architecture, applications will be requested and delivered as services, using web services standards like J2EE and .NET. For example, rather than being built redundantly into monolithic, vertically-integrated “order entry” and CRM applications, a discrete business process like “verify customer entitlement” may be delivered as an application service in both contexts.

- **Infrastructure services**—Infrastructure services deliver the secure, continuous computing power and storage capacity that applications require. In the past, resources were delivered by assigning servers directly to applications. But low utilization and the high cost of “one application, one server” policies are compelling organizations toward shared, virtualized, and on-demand solutions that make better use of processor and storage capacity. The HP adaptive infrastructure technologies and solutions accept requirements from and deliver infrastructure services to applications through open industry interfaces and web services.
- **Virtualized resources**—Virtualized resources provide the foundation for the Adaptive Enterprise, with computing power, information, and communications delivered as services abstracted (removed) from their underlying physical servers, storage, and network infrastructures. Sharing or pooling of IT resources helps eliminate over-deployed and underutilized technology components, reducing costs for hardware and software, and further reducing management complexity. Sharing IT resources across business functions also helps to increase business agility, enabling the rapid provisioning of new services or resources and scaling of established services.
- **Management software**—Management software analyzes demand signals from the organization, delivering business insight while managing and optimizing the user experience in a secure, continuous infrastructure. Infrastructure coordination and orchestration depend on moment-to-moment inventory and monitoring, planning, provisioning, and maintenance. By synchronizing infrastructure, application services and processes with business processes through automated and intelligent management and provisioning, HP enables enterprises to reduce the cost of change, reduce the total cost of ownership, simplify management complexity, and provide the enterprise with the ability to rapidly implement the solutions that provide the corporation with a competitive advantage.

Adaptive Enterprise customer benefits

HP Adaptive Enterprise enables companies to unlock all the benefits that can be gained by tightly linking business and IT in an enterprise, allowing them to adapt rapidly and continuously to changing business requirements, while also maintaining quality of service and controlling costs and risks. In the Adaptive Enterprise, IT drives business value, performance, and competitive advantage. AE benefits are summarized below:

Simplicity

- Reduce complexity
- Implement change quicker and easier
- Ensure that resources are working together

Agility

- Adapt in real-time to the business
- Drive change (time, range, ease)

Value

- Unlock the value of assets
- Free up resources for innovation
- Create competitive advantage

The HP difference

The HP difference consists of an architectural approach and value-added innovation.

Architectural approach

- Measure and assess
 - **Cost, quality, risk, agility** — The HP Consulting and Integration business unit provides a comprehensive range of assessment services across the key parameters for IT: cost, risk, quality of service, and now agility. The agility assessment is new, in keeping with today's requirements to cope with the rapid pace of business change.
 - **Time, range, ease** — HP has developed a structured methodology to assess the ability of a customer's IT organization to respond appropriately to business change. The methodology analyzes three agility dimensions (time, range, and ease) for a more multidimensional assessment, which provides powerful diagnostics about the impact of business change on IT. HP is the only company doing anything like this.
- Architect and integrate
 - HP offers a full suite of IT strategy, architecture, planning, and business case development services.
 - HP promotes design principles by using its Darwin design principles as guiding principles during this step. Plans based on these principles are proven to provide the most benefit in terms of improved adaptability, flexibility, and cost efficiency.

Value-added innovation

- Innovating in architecture
- Innovating in technology
- Delivering stability, efficiency, agility

The other key component to the HP difference is innovation. After all, the concept of “invent” is HP's heritage and lifeblood. HP is innovative with the architectures it designs. This is a source of value for customers and differentiation for HP. HP is innovating in its technologies also.

Adaptive Enterprise success stories

Two Adaptive Enterprise success stories are presented here.

Continental Airlines

The HP difference

Architecting and delivering unmatched availability and scalability



Adaptive design principles:

- Simplification
- Standardization

Customer business challenge ➡

- Differentiate as the airline that increases customer loyalty through the use of technology
- Increase revenue stream through technology
- Maintain extreme uptime and data integrity
- Deploy projects with an ROI of under 12 months
- Reduce long-term costs within the technology division

HP solution IT Consolidation/ Business Continuity ➡

- Design and mainframe migration services
- 2 NonStop, 7 HP 9000/HP-UX, 600+ ProLiant/Windows servers
- StorageWorks SAN (XPs, EVAs, tape libraries) and disaster-recovery solution
- OpenView and storage management software
- 200+ workstations, 3000+ Evo desktops
- 24x7 mission-critical support

Customer results/benefits

- Reduced server management and infrastructure cost
 - One-time saving >2M
 - Recurring annual savings >\$1M
- Highly available enterprise-wide solutions including data replication
- Enhanced web experience for customers
- Better capture of revenue relative to ticket reissues

Alcatel

The HP difference

- Innovative architectures
- Global approach on pricing/ integration/ service delivery
- Ability to meet Alcatel's high performance/high availability requirements



Adaptive design principles:

- Simplification
- Integration

Customer business challenge ➡

- Revenue growth despite 40% downturn in telecom equipment market
- Create technological breakthroughs to achieve competitive advantage (state-of-the-art network platforms and services)
- Cost reduction and operational flexibility are essential to withstand telecom industry volatility

HP solutions IT consolidation, managed services ➡

- Innovative data center and SAP consolidation in multiple regions; SAP help desk outsourcing
- Total managed print service in 100 European sites
- HP technologies to run key platforms: ProLiant, HP 9000 Superdome, AlphaServer, HP-UX and Linux operating environments, Critical System Support

Customer results/benefits

- 6-month ROI for Mobile Solution Division app environment system
- EMEA consolidation: ROI within 9 months
- 98% satisfaction rating for SAP help desk
- Followed successful HA solution in Canada: less than 5 minutes unplanned downtime in 5 years for business-critical SAP environment

Adaptive Enterprise: foundation for storage

- Adaptive Enterprise is the HP enterprise vision
 - Storage is delivered in terms of the Adaptive Enterprise.
 - The HP storage architecture is a subset of Darwin.
- ENSAextended
 - The HP strategy for delivering Adaptive Enterprise storage requirements
 - Primary focus is on Adaptive Enterprise rather than ENSAextended

Adaptive Enterprise is the HP vision and strategy for the enterprise and Darwin is **the** architecture. ENSAextended is the method for storage to provide the managed storage resources for Darwin. (ENSAextended should be de-emphasized.)

HP storage vision and strategy

HP storage vision

In support of the Adaptive Enterprise, the HP vision for storage is:

- A single, unified, managed storage ecosystem
 - Viewed as a single system by applications and administrators
 - One that can be partitioned to satisfy business needs
- Scalable in many dimensions
 - Capacity, performance, availability, manageability, geographic dispersion
- Self-aware, self-healing, self-managing, self-optimizing
- Storage management decoupled from external resources
 - Virtualization decouples storage presentation from physical resources
 - Storage management is decoupled from application/server management
- High degree of application awareness:
 - Resources are automatically, dynamically provisioned to meet application needs
 - On-demand storage delivery
 - Content and life cycle aware
 - Quality of Service based

Adaptive Enterprise: how storage contributes

Storage maps into the Darwin architecture and contribute to the Adaptive Enterprise vision through these architectural components:

- **Resources** — Storage provides raw resources that can be delivered to applications with increasing levels of managed behavior. For example, storage delivers raw data storage capacity, performance (IO/s, MB/s), and availability with arrays and tape subsystems. Storage networks provide connectivity resources, performance (bandwidth and cross-sectional bandwidth), and resiliency. Storage also provides resources in the form of structured overlays on native storage device formats using standard networked file systems (NFS, CIFS, etc.).
- **Virtualization** — Storage virtualization is more than just the pooling of storage capacity; it is also a way to deliver data. In addition to pooling storage capacity, HP virtualizes storage network paths between applications and data.
- **Infrastructure services** — Storage services provide the mechanisms to reliably deliver information to applications from virtualized storage resources. For example, application-specific interfaces can provide “application awareness,” as is the case with Information Lifecycle Management (ILM). Unlike the APIs that link resource management applications to resources (like SMI-S), these interfaces are business application oriented.

Storage security needs to be intimately tied to a general Darwin security model. HP is currently working on a comprehensive storage security model that covers the basic “A’s” (Access, Authorize, Audit) within the Darwin framework.

Data movement, the various replication technologies, and the other capabilities that were referred to as Infrastructure services in the ENSA storage architecture are all embedded in AE infrastructure services.

- **Management and control** — Today, HP delivers many storage management capabilities through OpenView SAM. These all fall into the AE “Resource level” management category. ILM will push us up a bit into “Service level” management.

Adaptive Enterprise: Storage offerings

This table shows how HP storage offerings map into the Darwin architecture.

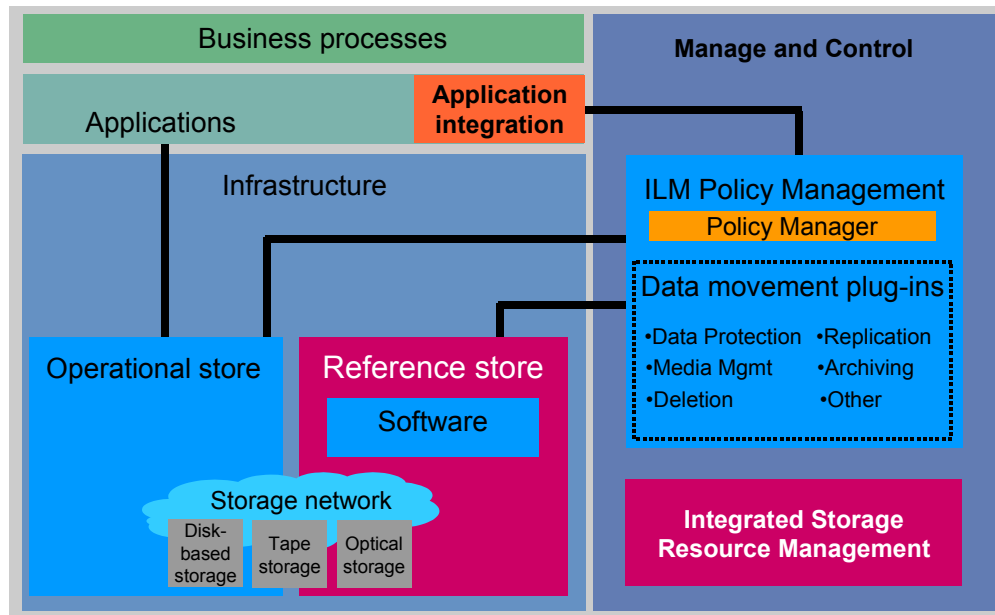
Darwin architectural element	HP storage offering
Resources	<ul style="list-style-type: none"> Storage systems: disk capacity (arrays), tape capacity (loaders, libraries), network capacity (FC, Ethernet, shared WAN, LAN) Resources flexibly provided: SCSI capacity (LU/LUN), files systems (NAS), Lustre clustered file system
Virtualization	<ul style="list-style-type: none"> Storage virtualization: Storage Virtual Replicator, EVA (VersaStor), Continuous Access Storage Appliance (CASA) Data path virtualization: SecurePath, fabric (via switches and path routing), storage arrays (via controller failover)
Infrastructure Services	<ul style="list-style-type: none"> Security: LUN masking, Selective Storage Presentation, fabric zoning, secure logon to management tools Replication: mirroring, point-in-time copy, snapshot, SnapClone, clone Data movement: Xcopy
Management & control	<ul style="list-style-type: none"> OpenView Storage Area Manager Suite, Data Protector, Business Copy, Continuous Access, ILM

Evolving networked storage management

In the Adaptive Enterprise, organizations can evolve from being technology-focused to service-focused to business-focused enterprises with increasing levels of agility. In the same way, customers can evolve to an adaptive, managed storage environment. As with other aspects of AE, customers do not need to apply all of these technologies, but the more they do, the more adaptive and resilient their environment will become.

Information Lifecycle Management (ILM) in the Darwin architecture

As the graphic below demonstrates, ILM (Information Lifecycle Management) provides an excellent example of how a broader storage solution easily maps into Darwin. This is a purely natural fit: ILM is a managed, application-focused solution that takes advantage of a number of different types of storage resources. Given control/access to the storage subsystems, ILM management applications move data among different classes of storage according to customer-set policies. ISRM (Integrated Storage Resource Management), which manages the storage resources in the infrastructure, is the foundation or starting point for ILM.

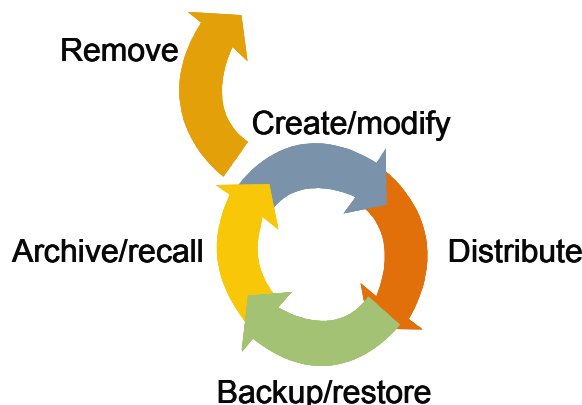


Information Lifecycle Management (ILM)

HP's definition of Information Lifecycle Management

Actively managing information:

- From creation to deletion
- According to its changing business relevance over time
- With automation to enforce application-specific policies
- To align with business and application needs



Today, many storage vendors offer a portfolio of products that manage the creation and modification, replication and distribution, protection and recovery, archive and recall, and removal of business critical information. These solutions exist within a particular stage of the information lifecycle. Examples of solutions that are offered within a particular stage include: array-based software for replication, tape- and disk-based backup and restore solutions, and archival solutions for tape, WORM, or other media.

An adaptive enterprise requires that information be managed throughout its lifecycle. This means utilizing policy-based storage services to automate the management of information based on that data's business value. And, it is important not only to manage the information, where and when it is needed, but also at the appropriate cost. We know that every piece of data has attributes assigned to it, IO for example, and those related to performance, availability, security, and geographic location. But the ability to truly take advantage of this important information is the next step to running business efficiently, with business agility.

ILM addresses three major information management challenges

ILM addresses three information management issues facing customers today:

Retention management: Companies need to comply with the many regulatory requirements impacting electronic record keeping. Many industries already have specific rules and regulations regarding the preservation of all electronic documentation including emails and instant messaging. These regulations include: Securities and Exchanges Commission rule 17a-4 and Health Insurance Portability and Accountability Act (HIPAA).

Any company may be required to produce documentary evidence of email communications in connection with a lawsuit (either as plaintiff or defendant). Companies need to ensure that emails are retained in alignment with appropriate legislation.

Data management: The growth of data has been well documented over the last few years. For example, email users are major consumers of storage capacity. Managing this increasing volume of data has created significant challenges for IT managers. The challenge they face is to maintain service level objectives with increasing amounts of data.

Reference information management: Information stored in for example emails can also be seen as an extension of a company's knowledge assets. It is predicted that companies will seek to extract maximum value from email and other information assets by mining archives.

HP ILM solutions today

HP's solutions to these ILM challenges span several vertical markets (healthcare, financial services, and life sciences) as well as Exchange solutions in the enterprise.

Customer challenge	HP Solutions
Retention Management	<ul style="list-style-type: none"> ■ Compliance and retention solutions ■ Archive and HSM/ MO Jukebox partners ■ Healthcare: Picture Archiving Communications Systems (PACS) and Healthcare Information Systems (HIS) ■ Email ■ Identify data to archive
Data Management	<ul style="list-style-type: none"> ■ Data replication and distribution ■ Data protection and recovery solutions ■ Identify data to archive or remove
Reference Information Management	<ul style="list-style-type: none"> ■ Email, office documents and digital imaging search and retrieval with ISV's ■ (new) HP Reference Information StorageSystem (RISS)

HP Services for ILM: your competitive advantage

A leader in both IT and service management consulting, HP Services offers a range of consulting services for ILM that can be tailored to customer requirements.

<p>DESIGN</p> <ul style="list-style-type: none"> • Strategic storage consulting • Adaptive storage architecture/design • Process driven from the start <p>BUILD and INTEGRATE</p> <ul style="list-style-type: none"> • Adaptive storage solutions • Deployment • Migration • Education <p>MANAGE and EVOLVE</p> <ul style="list-style-type: none"> • Managed storage solution • Storage support • Mission critical support • Multi-vendor support • Seek improvements where possible 	<p>Unique value of HPS</p> <ul style="list-style-type: none"> • ILM transcends storage — HPS has expertise across the IT infrastructure • ILM has strong process content — HPS is the leader in IT service management design • ILM contains multivendor components — HPS is the leader in heterogeneous environment services • Global presence for all ILM components implementation and support
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DSPP gets bigger — ILM partner program

HP/partner advantages:

- Go to market synergies
- Customer base
- Joint marketing
- Joint development and testing of solutions
- Comprehensive set of business and technical programs/services

Customer advantages:

- Reduce confusion and risk
- Assurance that ISV solutions work with existing storage environment
- Single accountability — HP can deliver the end-to-end solution
- Quicker time-to-solution

Program is available at <http://hp.com/go/ilmdspp>

Why HP for ILM?

- HP understands ILM.
- HP has the portfolio and the skills to provide a long-term solution to a long-term challenge.
- HP has the market share — storage, servers, applications (Exchange/Lotus Notes, Microsoft, SAP) — to be the logical partner for this.
- HP is committed, now and in the future. This is just the start.

ILM opportunity knocks

Who to approach	Triggers	What to avoid
<ul style="list-style-type: none"> • Compliance is not driven by IT. Look for: <ul style="list-style-type: none"> – Compliance officer or legal office – IT may be involved in the product selection • ILM opportunities start with uncovering the business need — it is a high-level sell, not an IT sell <ul style="list-style-type: none"> – Gives you access to management (with money) instead of IT architects (no money and lots of demands) 	<ul style="list-style-type: none"> • Retention management: <ul style="list-style-type: none"> – How is information currently managed? – How do you know which is the original? – How do you manage migrations? Unit wise? Application wise? • Compliance <ul style="list-style-type: none"> – To which rules do you need to comply? Who is affected if you do not? • Talk processes <ul style="list-style-type: none"> – Processes = money 	<ul style="list-style-type: none"> • IT can be a risk: <ul style="list-style-type: none"> – They may view it as another headache to manage – Are involved late in the game – Will go for the simplest, cheapest solution – Will be risk avoiding — playing into EMC's hands – Wants to know all the technical details

HP's future development of ILM functionality

- HP Services for ILM
 - Customer assessments; identify ILM implementation gaps
 - Compliance to industry retention standards; design and architecting cost-effective ILM infrastructure and processes
- Reference information store
 - A highly scalable and reliable archive based on low-cost disks
 - Store, index, search, and retrieve information
- Data movement
 - Near-term: Improve archiving functionality and management of disk-based replicas
 - Add true backup-to-disk capabilities within 12 months
- ILM policy management
 - Common framework for operational and reference data control
 - Central console to specify data policies and Quality of Service

HP StorageWorks Reference Information Storage System (RISS)

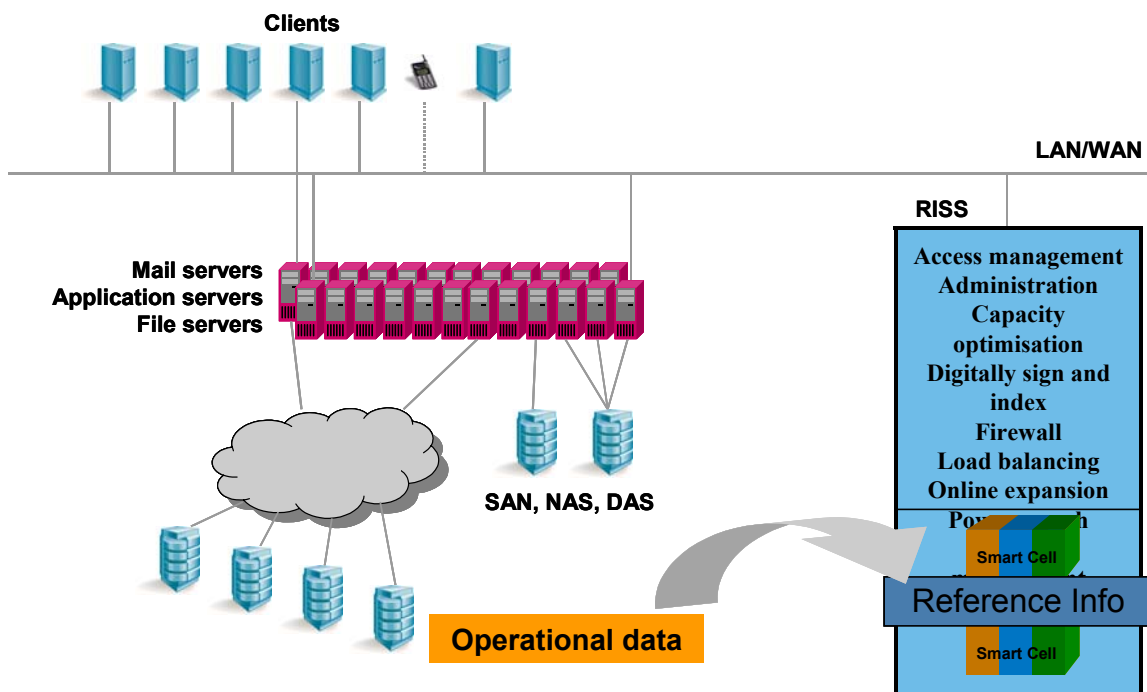
HP StorageWorks Reference Information Storage System is an archive appliance solution focused on rapid retrieval of reference information with full content indexing. HP StorageWorks RISS is one part of the HP ILM initiative to actively manage information.

- Full content indexing and grid computing for rapid search and retrieval
- Automatically harvest data from primary systems
- Time stamping and authentication to help comply with data retention regulations

HP StorageWorks RISS benefits

- Exploit data assets
 - Powerful integrated search tools
 - Grid computing to handle billions of emails
 - Fully integrated with end user application
- Manage costs
 - Fully integrated hardware, software, and services
 - Automatically removes duplicate data objects
 - Reduces redundant back up loads
- Compliance-enabled for data retention needs
 - Automated archiving of all new files and documents
 - Data is digitally signed, time stamped, and protected
 - Migration of legacy files to central archive

HP StorageWorks RISS topology



This is a schematic of a HP's RISS solution integrated into a typical client server production environment. The objective was a paradigm shift in the way reference data is stored, particularly in the ability to scale from GB to TB to PB without loss of performance or large increases in management overhead.

This objective was realized using a utility computing approach to build the reference information store. As shown here, the operational data is moved from the primary storage to the RISS.

The HP StorageWorks RISS is managed using a browse interface (Control Center). Integration with client applications means the data location is transparent.

HP StorageWorks RISS versus the competition

HP StorageWorks RISS	EMC Centera
A complete solution — reduces complexity of integration and support	Low cost disks; needs third-party software to complete any solution
Full content and attribute indexing and search	Relies on third-party applications for content indexing — capabilities different across different applications
Focus on rapid retrieval with storage smart cells and a grid computing architecture	Focus on storing data only; retrieval speeds depend on third-party software and additional hardware
All content and indexes stored within the RISS “non-tamperable” architecture.	Indexes stored outside of Centera with third party application; lose the index and you cannot access the archive!
Modular scalability — in increments as small as 1.2TB usable	Minimum upgrade is 8TB

Summary

- HP corporate strategy:
 - Focused innovation
 - World class cost structure
 - Best customer experience
- HP enterprise vision is Adaptive Enterprise:
 - “Business and IT synchronized to capitalize on change”
 - Based on the following design principles:
 - ◆ Simplify
 - ◆ Standardize
 - ◆ Modularize
 - ◆ Integrate
 - Darwin is AE’s architectural framework
 - Customer benefits include simplicity, agility, and value
 - HP offers a comprehensive range of services to support AE
- Storage vision and strategy:
 - ENSAextended is the HP strategy for delivering AE storage requirements (primary focus on AE versus ENSA)
 - Storage vision:
 - ◆ Unified and scalable storage ecosystem
 - ◆ Self-aware, self-healing, self-managing, and application-aware
 - ◆ Management decoupled from resources
 - Storage contributes to Darwin primarily via resources, virtualized resources, and resource level management
- Information Lifecycle Management
 - Definition: managing data throughout its lifecycle according to its business value, using policy-based automation
 - ILM addresses three information management issues: retention management, data management, and reference information management.
 - HP solutions span vertical markets (healthcare, financial services, life sciences) as well as Exchange solutions.
 - HP Services provides a full array of ILM services.
 - Who to approach — management or compliance officer/legal office

- HP Storage Reference Information Storage System
 - One part of the HP ILM strategy
 - Archive appliance for rapid retrieval of static reference data with full content indexing (grid computing architecture)
 - Benefits: exploit data assets, manage costs, comply with data retention regulations; scalable solution
 - HP is the only vendor to supply a complete archiving solution
 - ◆ No additional third-party software required

Learning check

1. Which of the following best summarizes the HP corporate value proposition?
 - a. HP customers get more.
 - b. HP demands more.
 - c. HP delivers more.
 - d. HP customers enjoy more.

2. Which three statements describe an Adaptive Enterprise environment? (Select THREE.)
 - a. A common foundation that can run any application and business process
 - b. An infrastructure driven by business strategy and business processes
 - c. An environment where IT supply meets business demand
 - d. A full suite of IT strategy, architecture, planning, and business case development services

3. Which three of the following refer to the ENSAextended strategy? (Select THREE.)
 - a. It is the HP strategy for delivering HP Adaptive Enterprise storage requirements.
 - b. It should be de-emphasized with customers.
 - c. It is the method used to provide managed storage resources for the Darwin architecture.
 - d. It is the architecture in which the Darwin architecture is a subset.

4. Which three of the following characteristics describe the HP storage vision?
 - a. Storage management tightly coupled to physical resources, with a view of all the physical details
 - b. Application-aware so that resources are automatically provisioned to meet application needs
 - c. Scalable in terms of capacity, performance, availability, and other dimensions
 - d. A unified storage ecosystem that can be partitioned to meet business needs

5. Select the correct phrase to complete this sentence: HP's definition of Information Life Cycle Management is the active management of information from creation to deletion, according to _____, with automation to enforce application-specific policies, and that aligns with business and application needs.
 - a. specific industry rules and regulations
 - b. its changing business relevance over time
 - c. best practices
 - d. the Darwin Reference Architecture

6. Which of the following is **not** a benefit of HP's StorageWorks Reference Information Storage System (RISS)?
 - a. Reduced storage management complexity via virtualization
 - b. Compliance with data retention regulations
 - c. Helps manage storage costs
 - d. Full content indexing and grid computing for rapid search and retrieval and scalability

Network storage solutions product portfolio

Module 5

Objectives

After completing this module, students should be able to:

- Identify the HP online storage array systems.
- Identify the HP SAN infrastructure devices.
- Identify the HP NAS systems.
- Identify the HP nearline storage systems.
- Identify the HP storage management software.




HP server portfolio

HP offers the world's broadest server portfolio, backed by focused innovation, world class partners, and integrated with services and solutions. The portfolio includes the industry-leading ProLiant servers, HP 9000 PA- and Intel Itanium-2 based servers, AlphaServer systems, and NonStop servers.

- **ProLiant** — Industry-standard servers optimized for Windows, Linux, and NetWare environments.
- **Itanium** — The Itanium processor family is an Intel processor family co-developed with HP that will provide performance that easily outstrips what is possible with earlier processor families. With its advanced architecture, the Itanium processor family will be the essential platform for the next generation of 64-bit computing, whether customers want HP-UX, Windows, or Linux.
- **PA-RISC** — HP introduced its first Precision Architecture (PA-RISC) processor in the mid-1980s and will continue to support the architecture for many more processor generations. HP PA-RISC servers run HP-UX for business-critical applications and share 100% binary compatibility with the Itanium processor family.
- **AlphaServers** — HP continues to deliver and support 64-bit Alpha chip solutions. HP and Intel share a collaborative technology agreement to provide AlphaServer and users with a smooth path to the Itanium processor.

HP storage support of Itanium servers

As of June 2003, HP storage supports Itanium servers as follows.

<p>Superdome</p>  <p>HP-UX Windows Linux</p>	<p>rx5670</p>  <p>rx2600</p> 	<p>HP Storage Support</p> <ul style="list-style-type: none"> • HP Disk Arrays <ul style="list-style-type: none"> •XP 128/1024 •XP 48/512 •EVA 5000 •EVA 3000 •VA 7410/7110 •VA 7400/7100 •Auto Path for HP-UX <ul style="list-style-type: none"> • No 64bit Auto Path this release •Secure Path for HP-UX, Win & Linux <ul style="list-style-type: none"> •No 64bit Secure Path this release •HP JBOD <ul style="list-style-type: none"> •DS2100/DS2110 •DS2300 •SC10 (HP-UX only) •FC10 (HP-UX only) •DS2405 (HP-UX only) •ESL & MSL Tape libraries <ul style="list-style-type: none"> •with LTO & embedded routers •with S-DLT & embedded routers •SAN Switches <ul style="list-style-type: none"> •Core 2/64, SAN 2/8, 2/8EL, 2/16 and 2/16EL
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HP NSS product portfolio

The HP NSS product portfolio is categorized as follows:

- Online storage arrays
- Network attached storage (NAS) systems
- SAN infrastructure devices
- Nearline storage
- Storage management software

HP NSS branding strategy

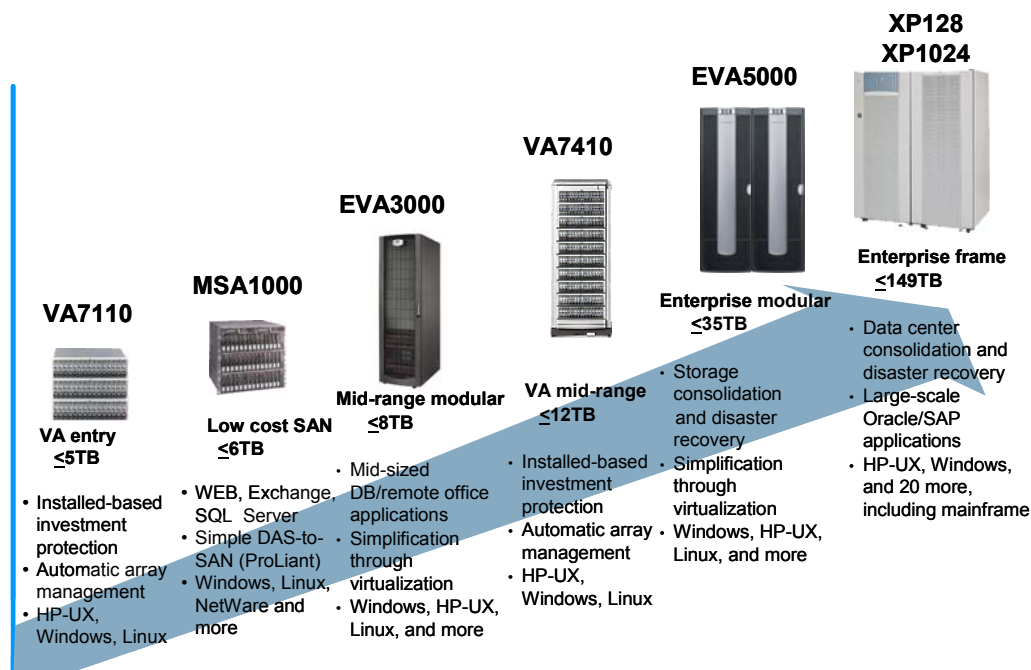
- One master brand — HP
- One vision — HP enterprise network storage architecture (ENSAextended)
- HP StorageWorks family name for hardware and solutions includes:
 - Disk arrays
 - Array APIs
 - Automation devices
 - NAS systems
 - Tape storage libraries and devices
 - Switches and routers
 - Controller firmware such as VCS
 - Platform software such as business copy and continuous access
 - Application solutions
- HP OpenView family name for storage software includes:
 - Host-based management software
 - Appliance-based management software
 - Management appliances
 - Management APIs
 - Software bundles
 - Other non-firmware software offerings

Note

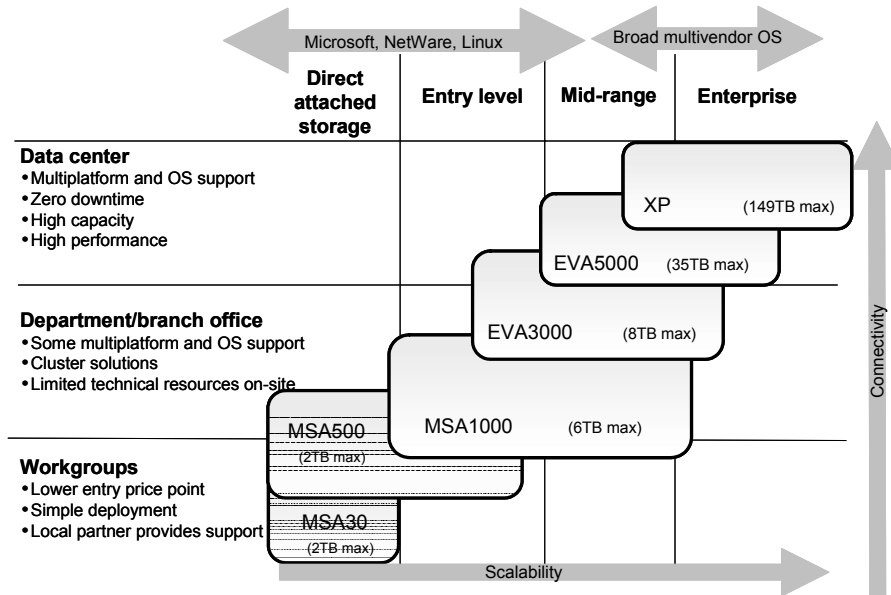
Individual product names follow product-naming strategies for HP StorageWorks and HP OpenView.

HP StorageWorks online storage array systems

The online storage array portfolio includes entry-level, mid-range and enterprise array systems. Modules 7, 8, and 10 describe XP, EVA, and VA arrays respectively.



HP StorageWorks array product positioning



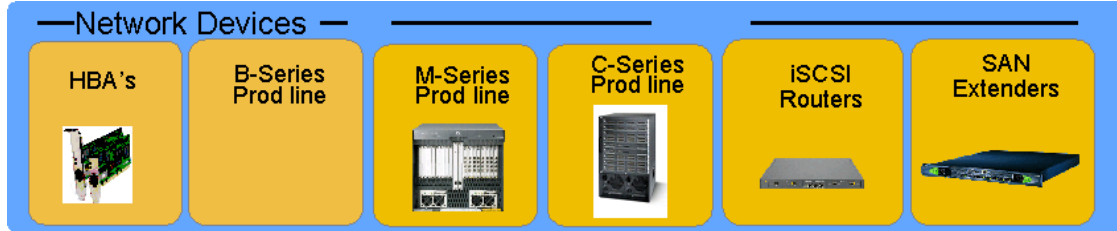
The MSA1000 is an entry-level array that offers one of the lowest-cost, high-performing SAN storage solutions on the market. The MSA's unique DAS-to-SAN capability enables easy migration from select direct attach storage systems to a storage area network. It is an ideal solution for web storage, Microsoft Exchange, and SQL Server. It is also an ideal solution for customers looking to hit price points typically associated with ATA-based storage offerings, but with more reliable and higher performing drives. HP has introduced numerous enhancements for the MSA such as expanded operating system support, an online backup solution, and expanded options for SAN environments.

The EVA family offers powerful enterprise-class functionality with unparalleled ease of use. The EVA simplifies storage administration and increases capacity utilization through the use of virtualization technology, which increases the customer's return on their IT investment. We have recently delivered numerous new features including expanded operating system and device support as well as remote data replication for disaster tolerance. The XP is ideal for enterprise-class data centers that require high scalability (up to 149TB), a wide range of operating system support (including mainframe), and the ultimate in performance and resilience. Continued HP investment in the XP is exemplified by several key enhancements, including expanded operating system and device support, and a pay-per-use solution.

Positioning	Array System	Description
Entry-level	HP StorageWorks Modular SAN Array 1000	<ul style="list-style-type: none"> ■ Full open system operating system support with full multiclustering. ■ Multipathing support for Windows, NetWare and Linux ■ DAS-to-SAN support ■ Universal SCSI disk drives ■ No business copy ■ No continuous access ■ No Fibre Channel disk drives
Entry-level	HP StorageWorks Virtual Array 7110	<ul style="list-style-type: none"> ■ Entry level UNIX array ■ Fibre Channel disk drives ■ No RAID level allocation ■ No virtual snapshots ■ No continuous access
Mid-range	HP StorageWorks Virtual Array 7410	<ul style="list-style-type: none"> ■ Mid-range array ■ Full heterogeneous support ■ Fibre Channel disk drives ■ Business copy ■ No RAID level allocation ■ No virtual snapshots ■ No continuous access
Mid-range	HP StorageWorks Enterprise Virtual Array 3000	<ul style="list-style-type: none"> ■ Mid-range array ■ Full heterogeneous support ■ Fibre Channel disk drives ■ Business copy ■ Continuous access (Q4 2003)
Enterprise	HP StorageWorks Enterprise Virtual Array 5000	<ul style="list-style-type: none"> ■ Enterprise array ■ Modular, TCO/price advantages ■ Full heterogeneous support ■ Fibre Channel disk drives ■ Business copy ■ Continuous access (synchronous) (asynchronous in Q4 2003)
Enterprise	HP StorageWorks XP - XP128 - XP1024	<ul style="list-style-type: none"> ■ Enterprise array ■ Designed for the largest (HP-UX centric) consolidation applications and offers highest levels of performance, scalability, and availability ■ Full heterogeneous support ■ Fibre Channel disk drives ■ Business copy ■ Continuous access

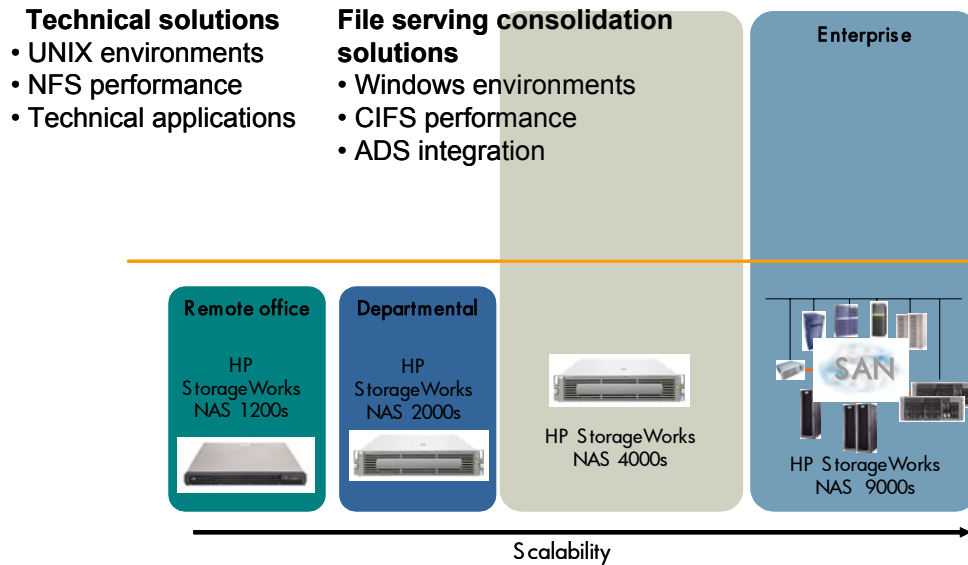
SAN infrastructure products

HP supports infrastructure products that contribute to varying degrees of connectivity, availability, performance, and cost. Module 13 describes switches and interconnects.



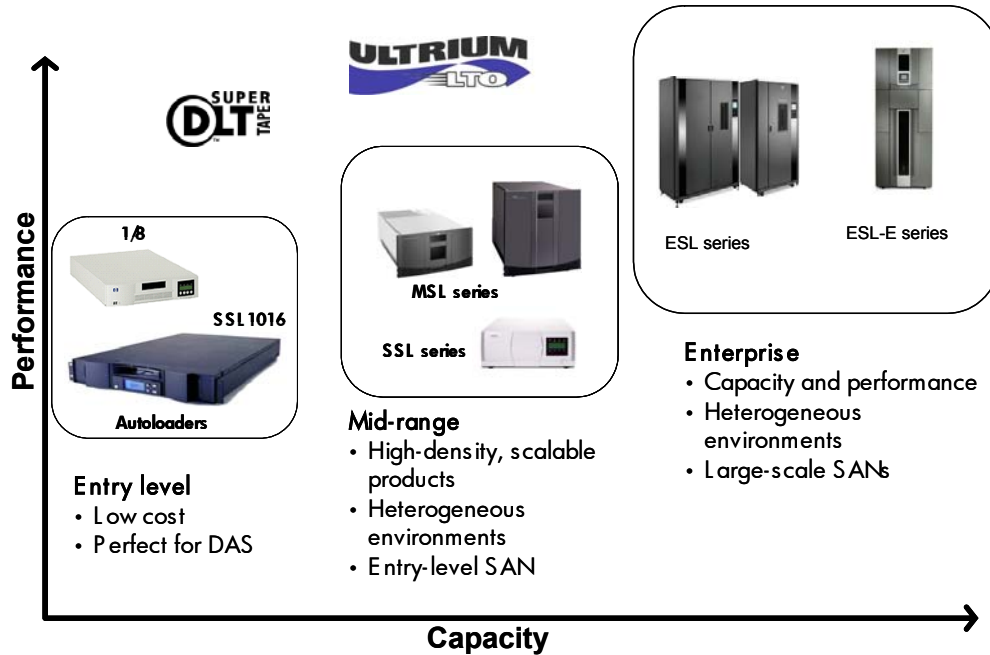
HP StorageWorks network attached storage systems

The NAS portfolio includes entry-level, mid-range and enterprise array systems. Module 11 describes the HP StorageWorks NAS systems.



HP StorageWorks nearline storage systems

The nearline storage portfolio includes entry-level, mid-range and enterprise backup systems. Module 12 describes the HP StorageWorks tape library systems.



HP storage management software

HP NSS offers the industry's broadest set of network storage management software solutions which are divided into the following categories. Module 14 describes HP OpenView SAM.

Software category	Description	Solutions
Storage area management (SAM)	Suite of integrated storage area management tools to improve management efficiencies across distributed, multivendor environments. HP OpenView SAM is part of HP OpenView software which enables customers to manage their infrastructure from a single console rather than a collection of individual devices and to visualize their infrastructure as a variety of services, enabling immediate root cause analysis of potential problems.	<ul style="list-style-type: none"> ■ HP OpenView SAM suite: <ul style="list-style-type: none"> - HP OpenView Storage Node Manager - HP OpenView Storage Allocator - HP OpenView Storage Optimizer - HP OpenView Storage Builder - HP OpenView Storage Accountant ■ HP OpenView Storage Provisioner ■ HP StorageWorks Command View SDM ■ HP StorageWorks Command View XP, EVA
Data Protection and management	Includes tape-based and disk-based backup and recovery for DAS, LAN, and SAN environments. HP also offers archival management tools for longer term backup and recovery	<ul style="list-style-type: none"> ■ HP OpenView Storage Data Protector ■ HP OpenView Storage Media Operations
High availability/disaster recovery	Includes server-based and controller-based software to help keep server applications and storage running 24x7 and protect business against unplanned downtime and loss of data	<ul style="list-style-type: none"> ■ HP StorageWorks Data Copy for NAS ■ HP StorageWorks Auto Path XP, VA ■ HP StorageWorks Secure Path ■ HP StorageWorks Business Copy XP, VA, EVA ■ HP StorageWorks Continuous Access XP, EVA ■ Cluster support for XP, VA, EVA
Virtualization	Host-, array- and network-based virtualization solutions	<ul style="list-style-type: none"> ■ HP StorageWorks XP ■ HP StorageWorks Virtual Controller Software with VCS snapshot for EVA ■ HP OpenView Continuous Access Storage Appliance (CASA) ■ HP OpenView Storage Virtual Replicator

Summary

- HP NSS product strategy
 - One master brand — HP
 - One vision — HP enterprise network storage architecture
 - HP StorageWorks family name for hardware and solutions
 - HP OpenView family name for storage software
- NSS product portfolio is categorized as follows:
 - Online storage arrays
 - NAS systems
 - SAN infrastructure devices
 - Nearline storage systems
 - Storage management software
 - ◆ Storage area management
 - ◆ Data protection and management
 - ◆ High availability and disaster recovery
 - ◆ Virtualization

Learning check

1. The HP NSS family name for platform software such as Business Copy is which of the following?
 - a. HP StorageWorks
 - b. HP OpenView
 - c. HP enterprise network storage architecture
 - d. HP ProLiant
2. Write the letter below indicating the HP branding convention next to the corresponding description.
A. HP StorageWorks **B.** HP OpenView
____ Family name for hardware solutions
____ Family name for storage software
3. Which of the following is array systems provide continuous access support?
 - a. HP StorageWorks Virtual Array 7110
 - b. HP StorageWorks Virtual Array 7410
 - c. HP StorageWorks Enterprise Virtual Array 5000
 - d. HP StorageWorks Modular SAN Array 1000
4. The HP StorageWorks MSL6000 tape library is positioned for which customer market?
 - a. Entry-level
 - b. Mid-range
 - c. Enterprise
5. HP OpenView Storage Media Operations is positioned within which of the following software categories?
 - a. Storage area management
 - b. Data protection and management
 - c. High availability/disaster recovery
 - d. Virtualization

Objectives

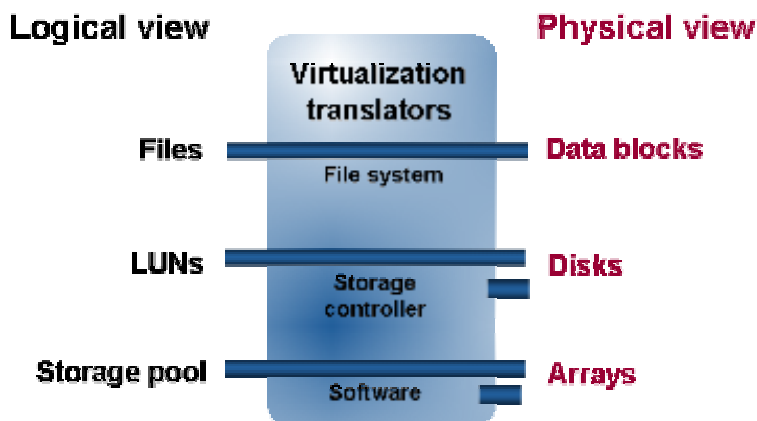
After completing this module, students should be able to:

- Define storage virtualization.
- Describe how storage virtualization works.
- Describe the three levels for implementing virtualization.
- Identify target customers for storage virtualization.
- Describe the value of virtualization.

Is virtualization something new?

- No! HP virtualized solutions are evolutionary, not revolutionary.
- Virtualization already exists at the server level:
 - Operating systems
 - File systems
 - Volume managers
- Virtualization exists in arrays in firmware that creates and manages LUNs.
- A server with a file system (for example, Windows) or a volume manager (Veritas Volume Manager), HP OpenView Storage Allocator, or an array with LUN management are all examples of virtualization. All of these products provide a virtual view of underlying physical data blocks.
- Example: My Documents folder on a Windows desktop is a virtual representation of some underlying blocks of stored data, usually located on your hard drive. The Windows file system is a virtualization translator. The folder or the listing of files (that you find after clicking the My Documents folder) is the logical view of physical data blocks.

Storage virtualization: a translator



With the help of translators, it is possible to logically view physical blocks of stored data through many mechanisms:

- File systems can present a logical view of data blocks through files. The My Documents folder is an example of a file system acting as a translator for data blocks.
- Likewise, a RAID controller can present LUNs, which represent physical data blocks contained across disks. LUNs can perform static or dynamic load balancing.
 - Static load balancing is maintained when LUNs are assigned to specific controller paths. For example, on a high I/O storage box, assigning LUN A to controller 1 and LUN B to controller 2 would allow a static load balance between controllers.
 - Dynamic load balancing options (round-robin, least I/O, least bandwidth) assign multiple LUNs to multiple ports on the same controller. For example, if both LUN A and LUN B are assigned to controller 1, I/O would move between ports 1 and 2 on that controller.
- Virtualization software presents a logical view, or virtual storage pool, that is physically comprised of data blocks that span multiple arrays.

Virtualization breaks down the physical barriers of the online environment and creates a single virtual pool. This enables increased utilization of storage assets and greater efficiency in the performance of storage administration activities, which ultimately extends to advanced storage services such as mirroring and snapshots across heterogeneous host/storage environments.

Storage virtualization defined

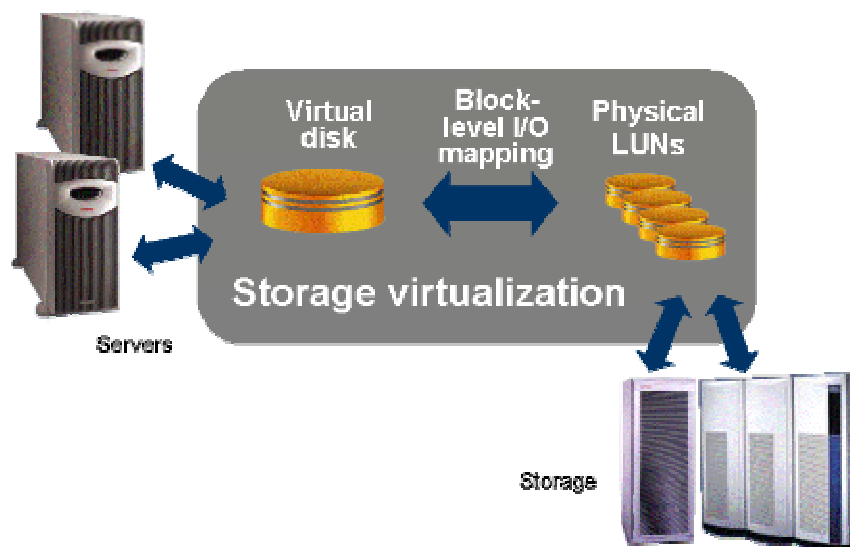
“The act of abstracting, hiding, or isolating the internal function of a storage (sub)system or service from applications, computer servers, or general network resources for the purpose of enabling application- and network-independent management of storage or data.”

Source: Storage Network Industry Association (SNIA)

Storage virtualization: what it is and what it is not

Storage virtualization is:	Storage virtualization is not:
<ul style="list-style-type: none">■ A logical view of physical resources■ A logical view of other logical resources■ A method for creating a common pool of storage from different disks or arrays■ A way to reduce complexity for the end user, simplifying storage administrative activities■ An enabler of additional storage services such as heterogeneous replication and migration	<ul style="list-style-type: none">■ A new concept, although some implementations are new■ A single defined technology■ Defined the same way by all vendors■ Always implemented the same way, even when different vendors use the same terms

How virtualization works



Storage resources are assembled into a storage pool. A virtual disk is created from the pool and presented to one or more servers in a way that is similar to traditional disk presentation.

The virtual disk can be allocated from anywhere in the storage pool. The server's applications cannot tell the difference between a virtual and non-virtual (traditional) disk. A mapping function occurs when a server I/O is initiated that translates the host view of the disk into the physical data within the storage pool. The physical data is also mapped back into the host virtual view when data is retrieved for the server.

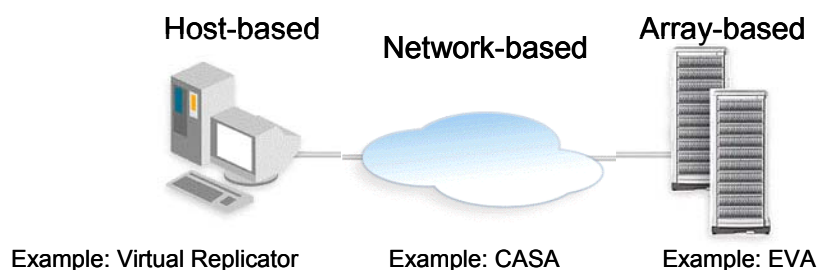
This creates a level of abstraction, called virtualization, between servers and storage. Being somewhat removed from the physical storage enables dynamic changes to the storage environment while eliminating application downtime.

Note that, from the application's point of view, nothing in the virtualized world has changed from traditional storage environments. An application sees a disk just as it always would. That disk could be

- A physical disk (JBOD) or RAID LUN in an EMA12000
- A physical disk embedded in a server
- A virtual disk

The application does not know or care what kind of disk it is. It only wants to make sure that it has some place to store the data and get it back when needed.

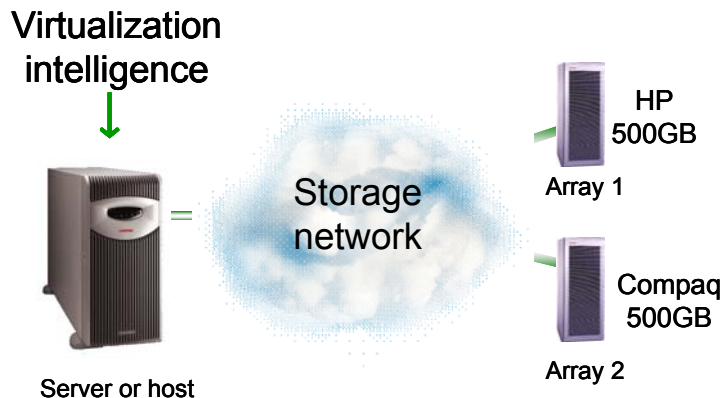
Three levels for implementing virtualization to meet individual needs



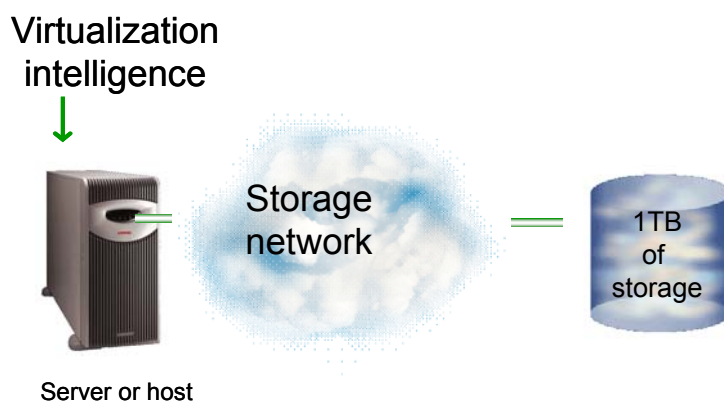
Virtualization technology can be implemented at three levels of the environment:

- **Host-based** — Host-based virtualization (also called server-based virtualization) is appropriate for small to mid-size homogeneous operating system environments. Specific software sits on the host and provides virtual disks for the host or cluster. Host-based software is unique to an operating system. Small environments can benefit from the increase in capacity utilization realized by “virtually” consolidating the existing storage assets. As the environment grows in heterogeneity and scale, and ownership tasks (such as, integration, training, deployment) increase, this implementation is of less usefulness and value to the customer. HP provides host-based virtualization for Windows DAS and SAN environments with HP OpenView Storage Virtual Replicator.
- **Array-based** — Array-based virtualization provides a point of consolidation, whereby all heterogeneous servers (attached to the array) gain the benefit of virtualization without the cost of numerous host-based deployments. An array that uses virtualization can significantly simplify the ability to exploit key functionality such as dynamic volume growth and local replication technologies such as snapshot and cloning. It also simplifies the ability to change the QoS (Quality of Service) of storage dynamically. Larger environments with a multitude of hosts and a single large array can benefit from array-based virtualization. The HP StorageWorks Enterprise Virtual Array is an example of an array-based virtualization platform.
- **Network-based** — Network-based virtualization exploits storage networking, resource sharing, increased connectivity, and the ability to scale performance, capacity, and availability while reducing the complexity of adding and removing storage and improving security and interoperability. Network-based virtualization enables many servers with different operating systems to perform I/O seamlessly to a storage pool comprised of many disparate arrays. Network-based virtualization is also a foundation technology for providing advanced storage services to heterogeneous environments as well as for providing a consolidated pool for more efficient administration. HP provides these services through the HP OpenView Continuous Access Storage Appliance (CASA) which, enabled by virtualization technology, provides local and remote data replication, snapshots and data migration across and between unlike storage devices from a variety of vendors.

Host-based virtualization



Let's take a look at host-based virtualization. In this simple configuration, a single server is attached to a storage network, as are two 500GB storage arrays. In this case, virtualization intelligence (software) is placed on the single server.

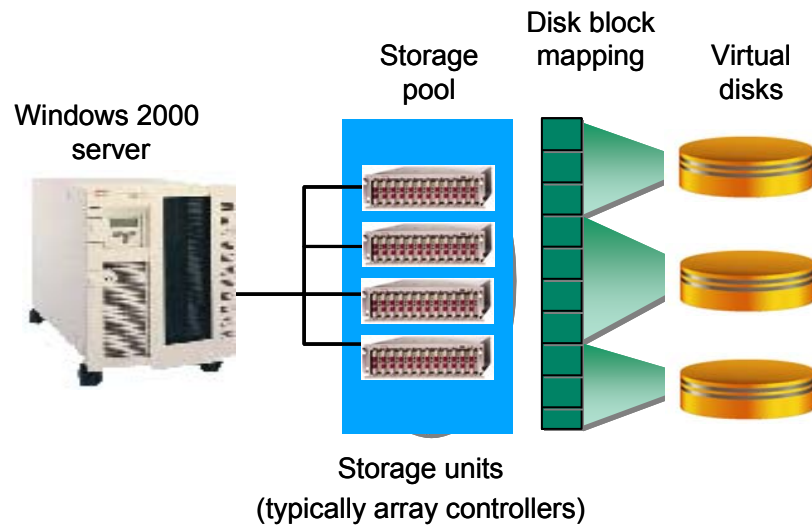


Server sees 1TB of storage as one logical unit of volume through server-based software

The virtualization software creates a single pool from the two disparate arrays and the server now sees a single logical unit of capacity that is 1TB in size. From this point, the pool can be expanded in a nondisruptive manner as well as divided as needed for application requirements. With appropriate additional software, snapshots can be created and data can be mirrored, all without consideration for the unique physical devices that make up the pool.

HP OpenView Storage Virtual Replicator

HP OpenView Storage Virtual Replicator is the HP product that provides host-based virtualization. HP OpenView Storage Virtual Replicator V4.0 provides storage virtualization for Windows 2000 and Windows Server 2003 operating environments.



The HP OpenView Storage Virtual Replicator binds heterogeneous storage units into a storage pool. Then it divides the pool into multiple virtual disks. It maintains mapping of physical to virtual disk blocks.

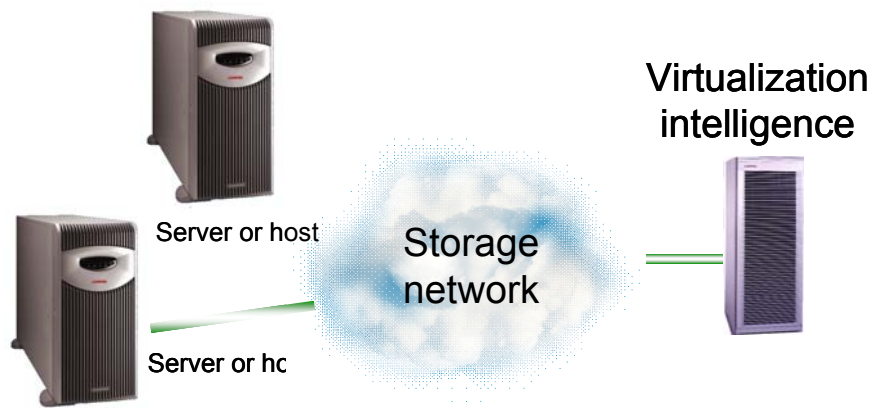
With HP OpenView Storage Virtual Replicator, storage managers can add new storage to the pool online while applications continue to run uninterrupted.

HP OpenView Storage Virtual Replicator value

HP OpenView Storage Virtual Replicator combines a rich set of capabilities that enhance and simplify storage administration. Virtualization enables storage consolidation and provisioning, online volume growth, and snapshot and administration features. HP OpenView Storage Virtual Replicator complements the standard capabilities within the operating system, using industry-standard server, storage, and network-interconnect components and protecting an organization's current and future storage investments.

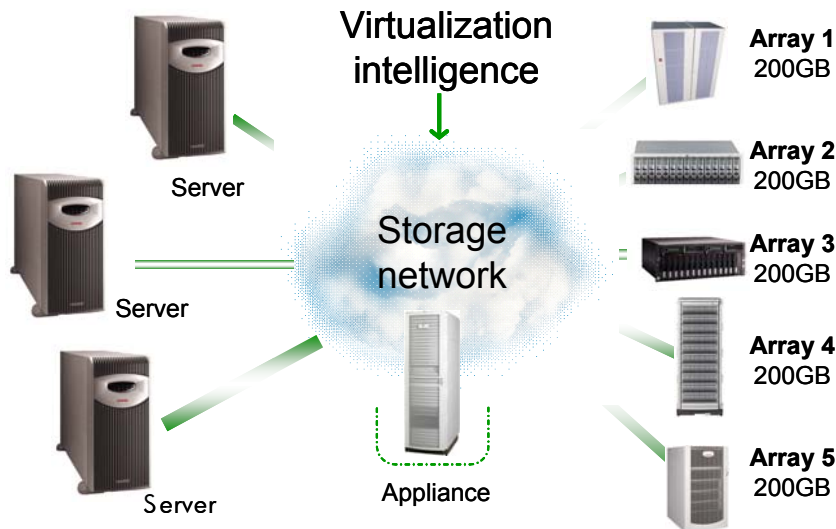
Features	Value
Storage consolidation and provisioning	Maximizes resource utilization and investments through storage consolidation and capacity provisioning tailored to the requirements of users and applications.
Centralized administration	<ul style="list-style-type: none"> ■ Reduces system administration costs with easy-to-use and automated administration features. ■ Simplifies administration tasks through easy-to-use interfaces using Microsoft Management Console or a command line. Interactive wizards are available to guide the administrator through all administration tasks and create automatic schedules of operations for investment protection and to reduce staff retraining.
Space-efficient snapshots	<ul style="list-style-type: none"> ■ Performs backups with minimal downtime, leaving production volume available to support normal business operations. ■ Enables the instant creation of multipurpose virtual replicas of production data without the requirement of a physical copy. Snapshots function identically to ordinary physical disks with both read and write capability. Whenever a quick copy of production data is needed, snapshots can be used with minimal disruption to running applications. For example, the snapshot can be the source for backup using standard backup tools. Snapshots can remain online for restore operations, application testing, and data mining.
Cluster aware	Provides higher availability for data and applications operating in the virtualized storage environment.
Online volume growth	Enables easy, non-disruptive growth for Windows 2000 with zero downtime. Online volume growth allows a system administrator to grow an existing volume on an HP OpenView Storage Virtual Replicator virtual disk and also a Windows 2000 basic disk. The system will remain online, and the data on the volume will remain intact.

Array-based virtualization

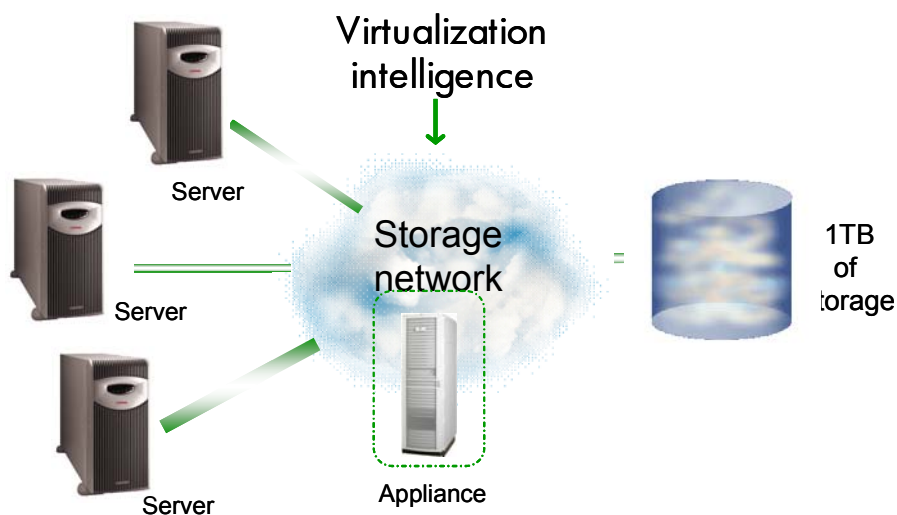


Now let's take a closer look at array-based virtualization. In this case, multiple heterogeneous hosts are connected to a single array. The virtualization intelligence sits on the array, which automatically stripes data across disks, tuning for better performance and eliminating hot spots. The HP array-based virtualization product, the Enterprise Virtual Array (EVA), is covered in detail in Module 8.

Network-based virtualization



Virtualization can also be implemented at the network level, creating a single pool of capacity for multiple heterogeneous hosts from multiple heterogeneous arrays.



The virtualization intelligence resides in the network, and in this implementation, is contained on an appliance. As you can see, the five individual arrays, each with 200GB of capacity, are presented to the host as a single 1TB pool. The HP network-based virtualization solution is the Continuous Access Storage Appliance (CASA). We will be discussing CASA in detail in Module 9.

Target customers

Who are the target customers for virtualization? Below are five situations where a closer look at storage virtualization is warranted:

Situation 1 — Storage networks with low storage utilization rates. Through the creation of a virtual pool, capacity that was previously stranded with a single array can be freed up for use with a variety of hosts and applications.

Situation 2 — IT administrators spending too much time on disk administration. Because actions can be taken on a single pool created from multiple arrays, storage administrators can more efficiently manage the storage pool.

Situation 3 — Business executives with imploding IT budgets. The virtualization benefits regarding capacity utilization and the ability to have higher level services such as replication and snapshot across heterogeneous environments can help business executives do more with their IT budgets. Storage requirements are continuing to grow, but with virtualization, IT dollars can go further.

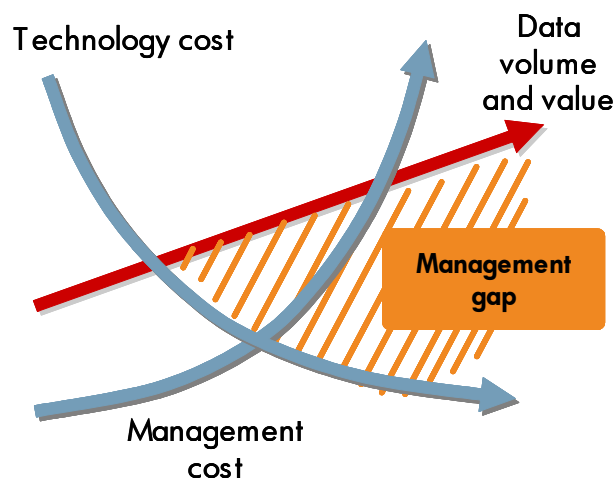
Situation 4 — Applications with unpredictable storage demands. Because of the ability to dynamically grow volumes and reallocate capacity, virtualized environments are particularly suited for applications with unpredictable capacity demands. In traditional storage architectures with volume expansion, the administrator creates a new larger volume and then migrates all the data from the original volume to the new larger volume. At a data transfer rate of 65GB/hr, this is a long process and impacts performance. With virtualization, you can just expand the size of the existing virtual disk. It takes moments to do, not hours.

Situation 5 — Heterogeneous environments requiring data replication. Data mirrors and snapshots are two very useful tools to ensure business continuity and data availability, but because of the cost associated with these capabilities, much of today's business-critical data—such as the data that helps customers support their customers—does not take advantage of these benefits. Enabled by virtual pool creation, replication solutions like the HP CASA can bring this higher level functionality to data physically located in lower cost arrays, thus supporting business critical data needs at a lower overall solution cost.

Note

Although virtualization enables **heterogeneous** replication in HP CASA, in homogenous host or homogeneous storage environments, replication can be accomplished without virtualization. Also, not all virtualization offerings provide replication capabilities.

Customer challenges



Source: Michael Peterson
In-Fusion

In general, most businesses are suffering from two basic truths—increasing demands for data from their users and greater efficiencies in managing that demand both in terms of costs and people. Storage virtualization can help close the gap by providing greater utilization of capacity and more efficient administration of the storage environment.

Value of storage virtualization

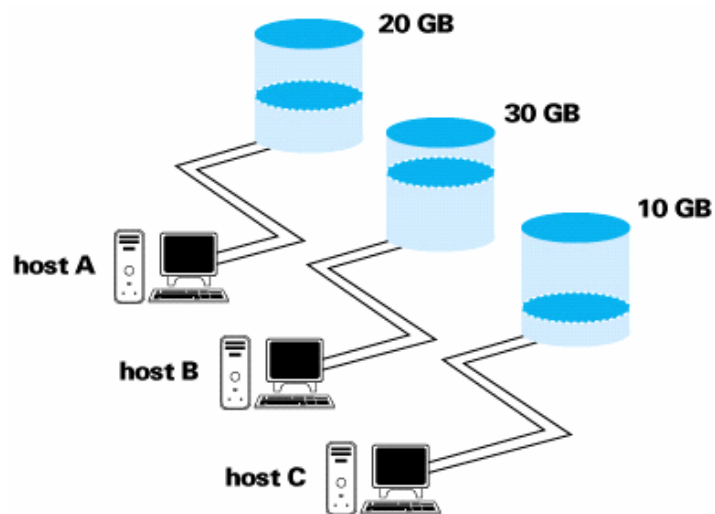
There are four principal areas of value that storage virtualization brings to customers.

- **Increased utilization** — Storage virtualization eliminates stranded capacity. Through the pooling of the capacity, multiple hosts and applications now have access to a complete pool and can more efficiently use the capacity of all disks in the pool.
- **Improved administration** — Virtualization creates a consolidated storage pool for centralized administration. Again, due to the creation of a single pool, administrative functions can be executed across all drives at the same time instead of repeating administrative tasks for each drive in the pool. This also standardizes administrative tasks.
- **Reduced application downtime** — Because virtualization enables administrators to perform maintenance activities on the entire pool without disrupting applications, downtime is reduced and, in some cases, is eliminated entirely.
- **Enabling capabilities across heterogeneous devices** — Traditionally, advanced storage services such as local and IP (Internet Protocol) mirroring, snapshot, and data migration occur between like storage devices or between devices attached to a single host or cluster. Today, enabled by the creation of a virtual pool, these services can be performed across unlike devices from different vendors—breaking down the barriers of the physical arrays and offering cost-effective business continuity solutions.

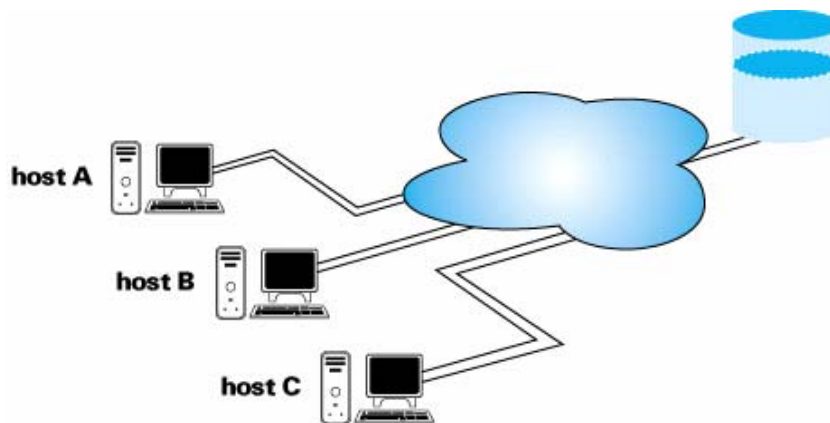
These storage services provide protection against data loss as well as lower replication costs.

We will take a closer look at each of these value components on the following pages.

Value of virtualization: increased utilization and storage consolidation



Although traditional distributed storage typically has a 30–50% utilization rate, virtualization increases utilization by creating virtual disks. The pooling of assets eliminates stranded capacity.



At the same time, virtualization achieves storage consolidation. By consolidating arrays from different vendors into a virtual pool, the administration of disparate arrays becomes easier and the useful life of older storage can be lengthened.

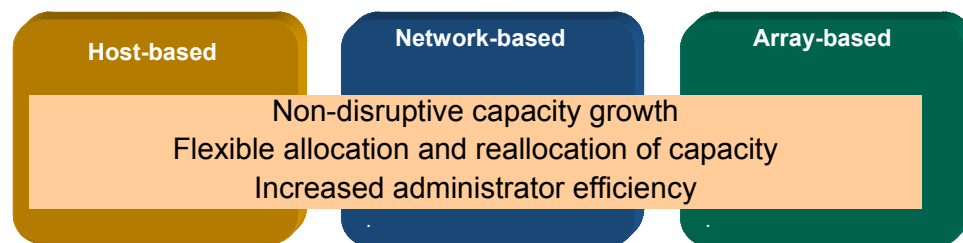
The storage consolidation can be achieved, in varying degrees, when implementing storage virtualization at the host, network, or array level.

Value of virtualization: improved administration

With virtualization, administrative functions can be performed across the heterogeneous storage pool. Through the efficiencies inherent in managing a virtualized pool instead of individual, heterogeneous storage devices, virtualization brings business value through greater administration efficiencies and lower administration costs. Using storage virtualization, storage managers can:

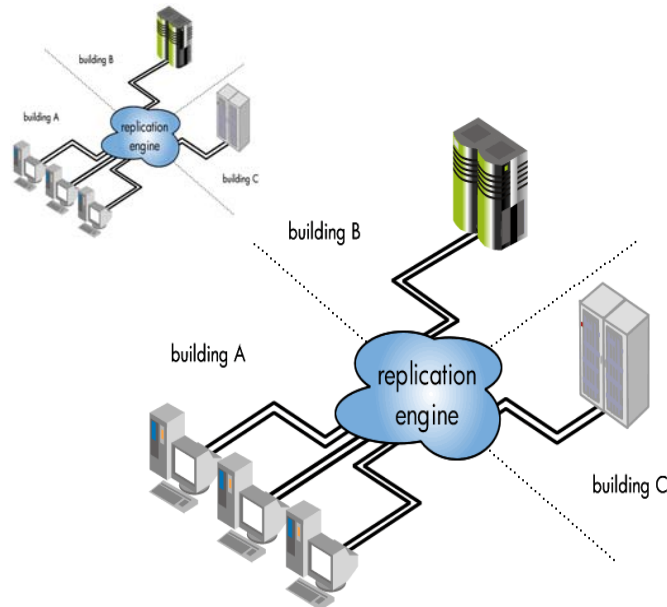
- Perform allocations from a central console
- Tune environments on the fly to eliminate hot spots
- Perform dynamic volume growth through LUN expansion
- Automatically migrate RAID level

Value of virtualization: reduced application downtime



Likewise, when storage is consolidated using virtualization, reductions can be seen in application downtime resulting from storage maintenance activities or outages caused by viruses, hackers, site failures (for example, power and temperature), and operator error. Again, this benefit is achieved regardless of where the technology is implemented. Non-disruptive capacity growth, flexible allocation, and reallocation of capacity all lead to increased administration efficiencies.

Value of virtualization: enabling heterogeneous support



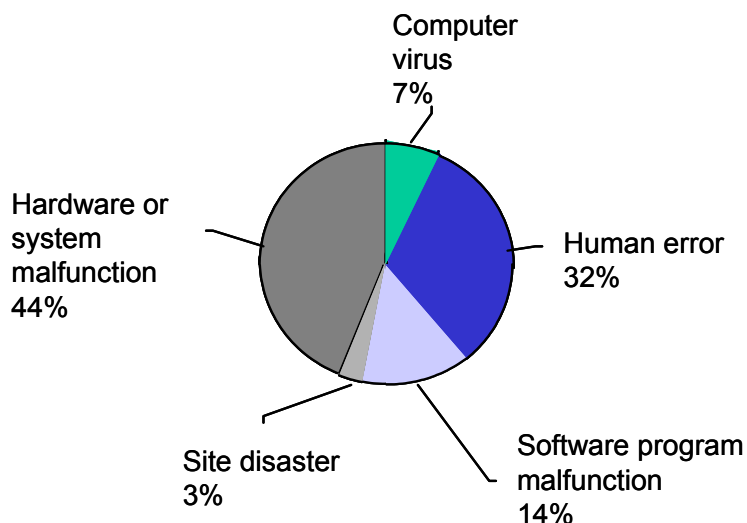
Virtualization enables advanced capability across **heterogeneous** components. Particularly when coupled with higher level storage services such as mirroring and snapshots, virtualization can play a large role in improving business continuity by protecting against various forms of data loss.

These include:

- Computer virus
- Human error
- Software program malfunction
- Site disaster
- Hardware or system malfunction

Value of virtualization: protection against data loss

Let's look at the causes of data loss in more detail and examine how virtualization protects against data loss.



Source: Ontrack, a data availability service provider

- **Computer virus and human error** — Snapshot copies of data help companies recover from attacks and help protect against human error.
- **Software program malfunction** — Local copy allows testing of software before production.

Note

A software program malfunction can occur in a production system. Snapshot copies can provide faster restore times when these incidents occur.

- **Site disaster** — Virtualization can also help protect against data loss caused by a site or natural disaster or by a hardware or system malfunction. In the case of site disaster, virtualization with remote replication can provide more cost-effective implementations for protection.
- **Hardware or system malfunction** — RAID, clustering, and local/remote mirroring protect against hardware failure or system malfunction.

Value of virtualization: reduced replication costs

Storage virtualization provides another capability in heterogeneous host/storage environments—data replication. In addition, virtualization reduces replication costs.

Although not all data needs to be mirrored or copied, business processing should be constrained by the cost of data copies. Copies should be able to reflect different requirements for performance and availability. The underlying cost of capacity for each copy should be different depending on the copy requirements—not constrained by the production requirements. Many customers, because they are locked into using the same array type for copies as their production array type, pay a high cost for copies, and they need to manage the cost incurred by creating these copies.

Assume that a customer has virtualization at the network level with a group of heterogeneous arrays. Virtualization allows the customer to pool capacity from arrays with different costs. This is a way to reduce the actual cost of the copies. Instead of being locked into copies at the same cost per megabyte as the production data (high performance and high availability), a customer can leverage the investment in lower cost storage for the copies. Even when you add in the cost of the management appliance that virtualizes the storage and provides the advanced storage services, the customer has a total solution at a much lower cost.

This example ignores the fact that the customer could create copies from space-saving snapshots that only require about 10% of the capacity of a full copy. Using space-saving snapshots would lower the total solution cost even further.

Methods of protecting against data loss

Host-based virtualization	Array-based virtualization	Network-based virtualization
<ul style="list-style-type: none"> Space-efficient snapshots for fast backup and data recovery in heterogeneous storage environments. Data replication for Windows-based operating systems. 	Data replication (snapshots and mirroring) for heterogeneous host environments.	Data replication (snapshots and mirroring) and data migration for heterogeneous host/storage environments.

You may be asking, what does all this have to do with storage virtualization? There are two major reasons why businesses do not have snapshots and mirrors of all their data in order to prevent data loss:

- The first is cost—the software can be expensive both in terms of acquisition costs and in terms of administration.
- The second is that some of the functionality is not available for the arrays they own. With heterogeneous virtualization, particularly at the network level, these higher level functions can be deployed across the virtualized pool, often for a fraction of the cost of homogeneous solutions.

Summary

- Storage virtualization is a logical view of physical resources that simplifies storage administration and enables replication, snapshot, and data migration to be performed across this pool.
 - Storage resources are assembled into a storage pool, and a virtual disk is created from the pool and presented to the servers.
 - The mapping function translates the virtual view into physical data and vice versa, creating virtualization between servers and storage.
- There are three levels for implementing virtualization
 - Host based
 - Array based
 - Network based
- Five customer opportunities for virtualization include:
 - Storage networks with low storage utilization rates
 - Networks where administrators spend too much time on disk administration
 - Executives with imploding IT budgets
 - Applications with unpredictable storage demands
 - Heterogeneous environments requiring data replication
- The business value of virtualization includes:
 - Increased utilization
 - Improvement of administration
 - Reduction of application downtime
 - Enabling of capabilities across heterogeneous devices for protection against data loss and lower replication costs

Learning check

1. In virtualization, storage resources are assembled into a _____, and a _____ is created from the pool and presented to the servers.
 - a. storage pool, mapping function
 - b. storage pool, virtual disk
 - c. LUN, virtual disk
 - d. physical disk, JBOD
2. A _____ occurs when a server I/O is initiated that translates the host view of the disk into physical data.
 - a. virtual disk
 - b. LUN
 - c. mapping function
 - d. server
3. The HP host-based virtualization product that enables storage consolidation and simplifies administration is:
 - a. Enterprise Virtual Array (EVA)
 - b. HP OpenView Storage Virtual Replicator
 - c. CASA
 - d. Virtual RAID
4. Which target customer **is not** appropriate for virtualization?
 - a. Storage networks with low storage utilization rates
 - b. Networks where administrators spend too much time on disk administration
 - c. Heterogeneous environments requiring data replication
 - d. Applications with highly predictable storage demands
5. Which of the following is **not** a benefit of HP storage virtualization?
 - a. Increased utilization
 - b. Reduced application downtime
 - c. Continuous access
 - d. Mirroring across heterogeneous devices

Objectives

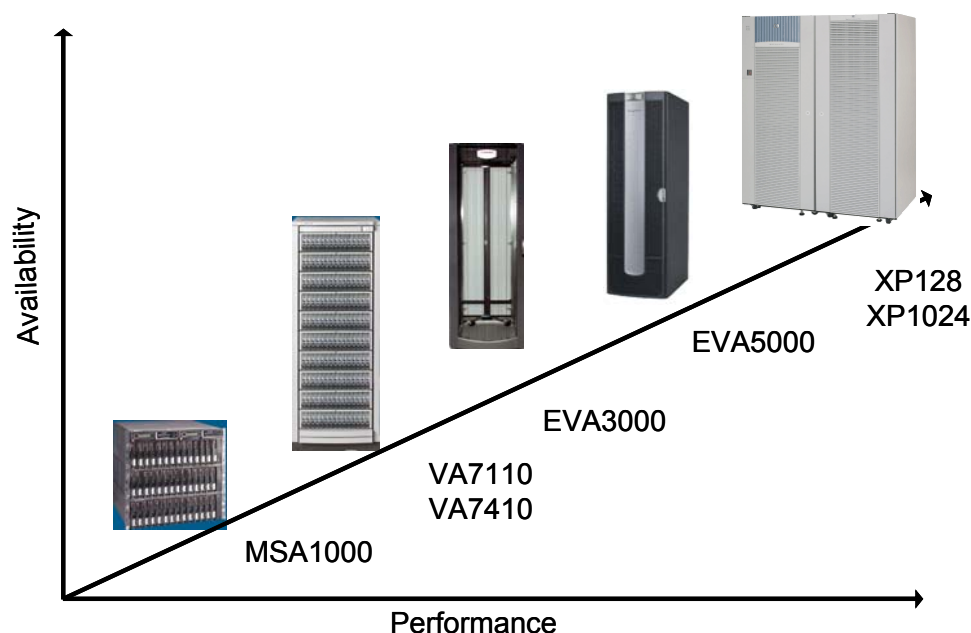
After completing this module, students should be able to:

- Position HP StorageWorks XP within the StorageWorks system array family.
- Identify HP StorageWorks XP target customers and customer characteristics.
- Identify the customer challenges that HP StorageWorks XP addresses.
- Describe the HP StorageWorks XP value proposition.
- Describe the HP StorageWorks XP software. Describe the HP StorageWorks Pay Per Use XP program

Overview

HP XP disk arrays and XP software products are designed to meet the needs of enterprise customers who require extreme availability and/or capacity. The XP is a critical solution in the HP high-end disk array portfolio that leads the industry in business value, performance, scalability, and flexibility.

HP online storage array portfolio



The EVA and XP families are high-end solutions for enterprise customers. They are different in that the XP is a frame-based array and the EVA is a rack-based array. Each has distinct features and benefits that best meet specific customer needs.

XP customers and target industries

The XP meets the needs of the most demanding environments in the enterprise storage market. XP customers almost always have one or both of the following characteristics:

- Extremely high volumes of data (10–20TB)
- Need for extreme availability

Although these characteristics may be true of customers in any industry, XP target industries include the following:

- Telecom
- Manufacturing
- Retail
- Oil
- Defense
- Financial services

Customer business needs

By offering more performance at higher capacity points, the HP StorageWorks disk arrays are meeting the needs of the high-end storage market, providing significant value for customers. Specifically, the XP addresses the following customer business needs:

- **Business continuity** — protects business operations, which are especially important in mission-critical computing environments requiring 24x365 availability.
- **Data protection/disaster recovery** — protects data and minimizes downtime to enable operations with minimal impact to the business by providing array-to-array remote copy capability.
- **Simplified/more efficient management** — enables the efficient configuration, management and maintenance of storage resources. The XP, with its high performance, is an outstanding solution for storage consolidation.

XP value proposition

The HP StorageWorks Disk Array XP provides large capacity, extreme availability, and high-end storage for mission-critical environments.

The XP is ideal for customers in mission-critical enterprise environments who require a scalable, reliable, and easily managed high-performance storage system. The value of an XP solution is that it enables customers to focus on their business — knowing that their most important concerns of availability, security of data, and speed are met by a complete and robust end-to-end solution.

HP StorageWorks disk array XP1024

The HP StorageWorks XP1024 disk array delivers state-of-the-art architecture, software, and solutions. It accommodates the highest number of disks of any disk array available, offering up to 149TB of storage capacity, while supporting heterogeneous connectivity.

The XP1024 uses advanced crossbar fault-tolerant, redundant architecture, optimizing performance for a broad set of applications. No single-point-of-failure and non-disruptive online upgrades ensure that the infrastructure is “always on, always available.” With its extremely high storage capacity and a remarkably small footprint, the XP1024 meets customers’ storage needs today and in the future.



XP1024

Key features of the XP1024 disk array

- 10.4GB/s crossbar switch
- Up to 149TB capacity (146GB disks)
- No single point-of-failure
- 4 to 64 FC ports
- 8 to 1024 native FC disks
- Up to 128GB mirrored cache
- Up to 6GB shared memory
- 36GB-15K, 73GB-10K, 73GB-15K and 146GB-10K disks
- RAID 0/1 2D+2D 4D+4D
- RAID 5, 3D+1P, 7D+1P, over 129TB usable capacity
- Multiple operating systems per port supported
- “Phone home” capability to HP “stress-free central”
- Advanced remote diagnostics/proactive monitoring
- Metro and continental cluster disaster recovery solutions
- Full solution (host-SAN-storage) support
- Online firmware updates
- Extended heterogeneous operating system connectivity for: HP-UX, Linux, Windows NT, DataCenter, AIX, Solaris, OpenVMS, Tru64 UNIX, mainframe, Dynix PTX, NCR, SGI-IRIX, OS/2
- Supports mainframe host interconnections: 1-2 Gb/s Fibre Channel, FICON and ESCON

HP StorageWorks disk array XP128

The HP StorageWorks disk array XP128 is the highest-performance system in its class. It offers heterogeneous connectivity and broad multiplatform open systems. The XP128 provides up to 18TB of capacity, enabling systems to grow and meet increasing business needs. In addition to high performance and incredible reliability, the XP128 resides in a one-cabinet system for the efficient use of data center floor space.

The XP128 uses advanced crossbar fault-tolerant, redundant architecture optimizing performance for a broad set of applications. No single-point-of-failure and non-disruptive online upgrades ensure that the infrastructure is “always on, always available.” The XP128 is the best choice for demanding heterogeneous environments where data center space is a premium.



XP128

Key features of the XP128 disk array

- 5.2GB/s crossbar switch
- Up to 18TB capacity (146GB disks)
- No single point-of-failure
- Up to 24FC or 16 ESCON host ports
- Up to 128 native FC disks
- Up to 64GB mirrored cache
- Up to 6GB shared memory
- Up to two ACPs (with two CHIPS)
- RAID 0/1 and RAID5 capabilities
- 36GB-15K, 73GB-10K, 73GB-15K and 146GB-10K disks
- “Phone home” capability to HP “stress-free central”
- Multiple operating systems per port supported
- Metro-wide and continental disaster recovery solutions
- Full solution (host-SAN-storage) support
- Online firmware updates
- Extended heterogeneous operating system connectivity for: HP-UX, Linux, Windows NT, DataCenter, AIX, Solaris, OpenVMS, Tru64 UNIX, mainframe, Dynix PTX, NCR, SGI-IRIX, OS/2
- Supports mainframe host interconnections: 1-2 Gb/s Fibre Channel, FICON and ESCON

Key features and benefits of the XP128 and XP1024 disk arrays

XP128 and XP1024 features can be organized by three characteristics: controllable, resilient, and extensible.

Controllable

- **Manageable** — manages many arrays from a single web-enabled console
- **Serviceable** — replaces any component online with no interruption to applications or hosts

Resilient

- **Reliable** — provides extreme reliability and availability with redundant hot-replaceable processors, I/O interfaces, power supplies, batteries, and control processors

Extensible

- **Open** — supports multiple operating systems including HP-UX, Linux, Microsoft Windows 2000, HP Open VMS, HP Tru64IX, NetWare, IRIX, and mainframes
- **Flexible** — supports mixed disk environments and is backward compatible with 1–2Gb Fibre Channel, FICON, and ESCON
- **Scalable** — scales up to 1024 disk drives or over 129TB (XP1024) and up to 128 disk drives or over 16TB of usable storage in a single array to accommodate growing storage needs

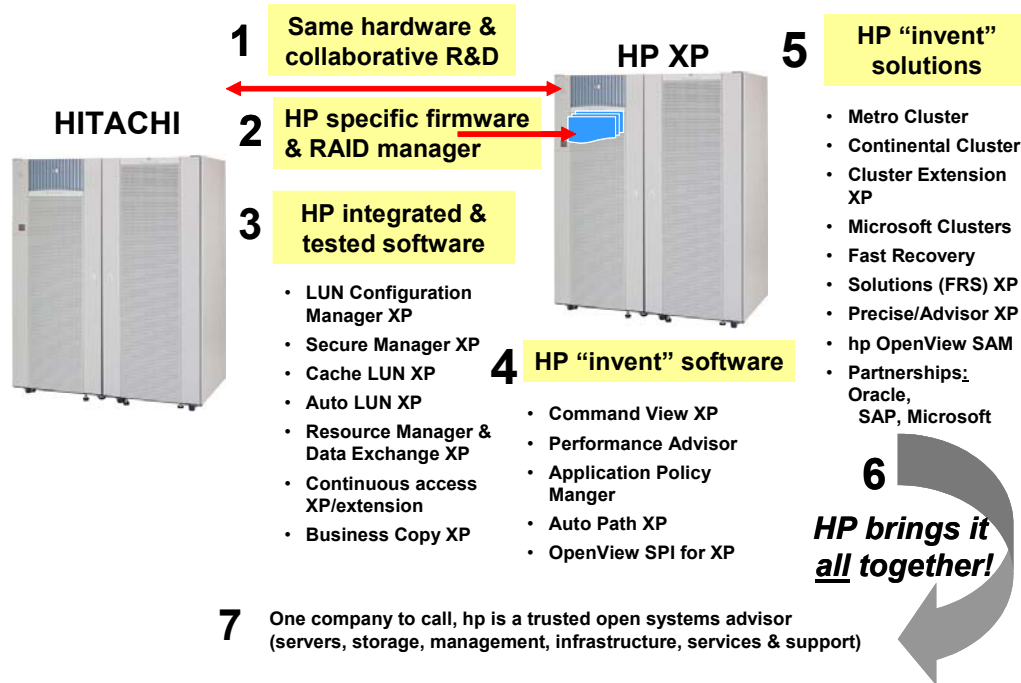
Comparison of the XP128 and XP1024

	XP128	XP1024
Maximum disk drives	128	1024
Maximum capacity	18.6TB raw	149.5TB raw
Maximum aggregated crossbar throughput	7.5GB/s total 5GB/s data 2.5GB/s control	15GB/s total 10GB/s data 5GB/s control
Maximum sequential data transfer rate	1.1GB/s sustained 2.4GB/s peak from cache	2GB/s sustained 3.2GB/s peak from cache
Maximum random IOPS from cache	375,000	500,000
Cache memory	64GB	128GB
Shared memory	6GB	6GB
Maximum host connectivity ports	48	64
Maximum LDEVs	8192	8192
Physical footprint (h x w x d)	73.2 x 30.8 x 31.5 in (1,860 x 782 x 800 mm)	DKC: 73.2 x 30.8 x 31.5 in (1,860 x 782 x 800 mm) DKU: 73.2 x 28.6 x 31.5 in (1,860 x 750 x 800 mm)

XP software advantage

HP will continue to OEM Hitachi Data Systems (HDS) 9900 series storage arrays as the HP StorageWorks Disk Array XP family through 2008.

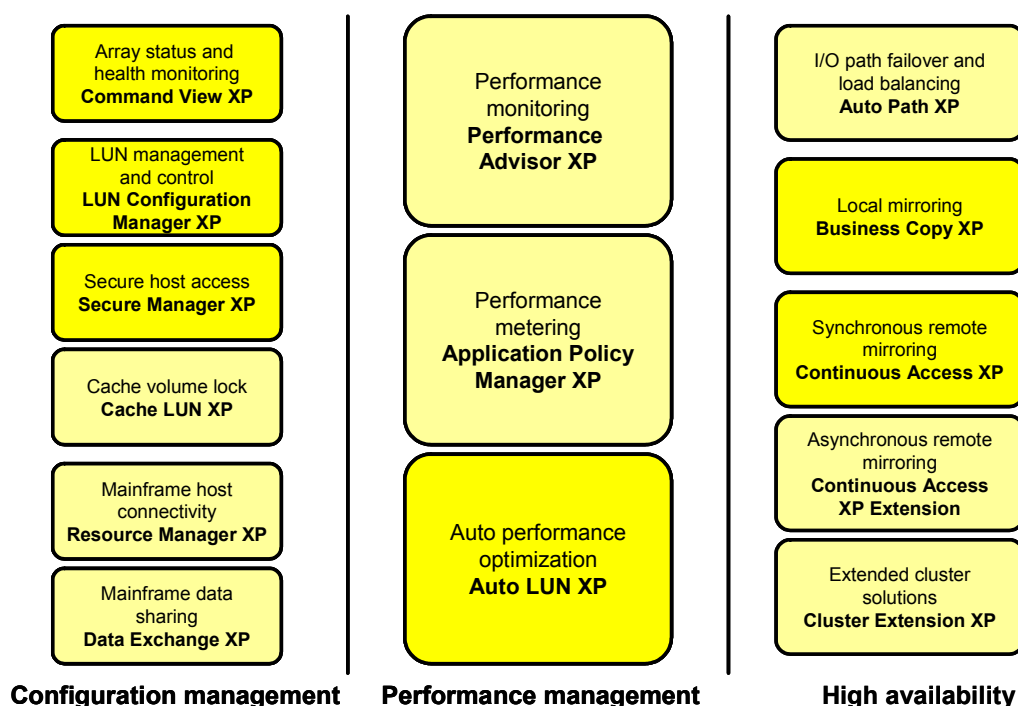
HP creates additional business value and differentiates the XP arrays from HDS 9900 arrays with software.



XP software portfolio

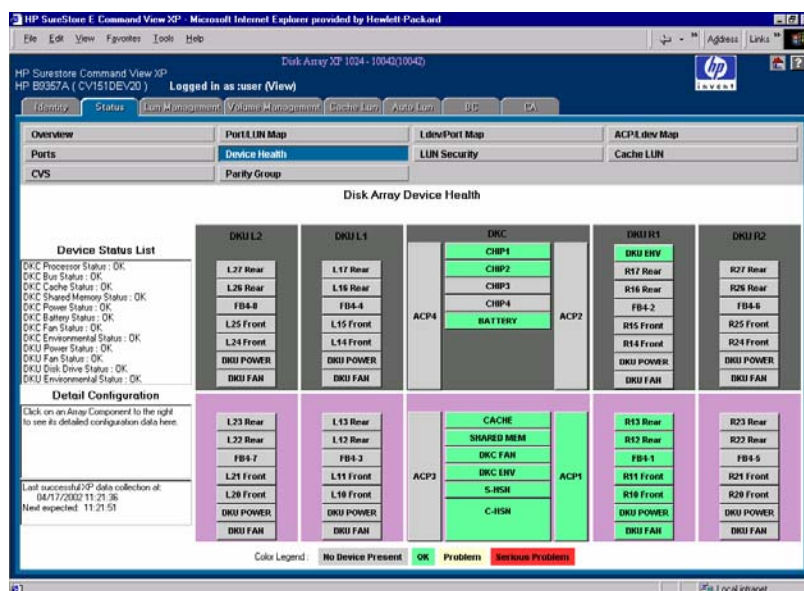
The HP StorageWorks XP software portfolio is critical in providing value to clients. Storage is not a standalone technology solution; it must fit within customers' existing infrastructure, with minimum disruption. HP has enhanced its storage solutions by developing software tools that increase customers' efficiency and simplify management, enabling customers to focus on business rather than storage.

The HP StorageWorks XP software portfolio spans the realms of data protection and network storage needs. It includes solutions for backup and restore, disaster recovery, centralized management, and data sharing. This portfolio of products is designed for use only with HP XP disk arrays.



Command View XP

Command View XP is a web-based management framework that provides centralized management of the XP disk array family. Command View helps reduce storage cost of ownership by providing intuitive tools and graphical mappings to increase the efficiency of administrators. Many of the tools provide diagnostic capabilities to reduce time spent troubleshooting, ensuring higher availability of storage resources.



Features

- Common interface for device value add applications
- Graphical representations and diagnostics of Fibre Channel I/O paths
- Supports XP128/XP1024 and legacy platforms from single console
- Visually displays configurations

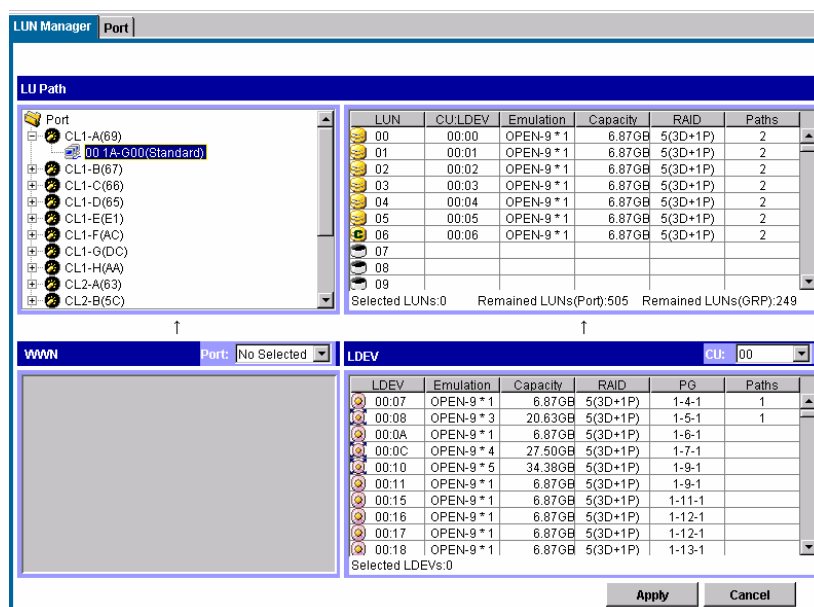
Benefits

- Common management across HP storage devices
- Graphical visualizations accelerate problem resolution
- Multiple security layers ensure that information is safe and secure
- Manage storage anytime, from any where
- Enabler for remote support

LUN Configuration Manager XP and Secure Manager XP

The role of the LUN Configuration Manager XP is to configure and tune the storage environment to meet changing requirements. It provides tools for users to configure an array when changes are needed due to a dynamic user environment. LUN Configuration Manager XP contains three applications in a tool that launches directly from the Command View XP user interface. The package includes tools for LUN management, LU size eXPansion, and volume size configuration.

Secure Manager XP enables customers to share a single Fibre Channel array among multiple servers while keeping data separate and password-protected. It allows each host connected to an array port to see only assigned storage while enabling secure, multi-host-per-port access for SAN environments.



Features

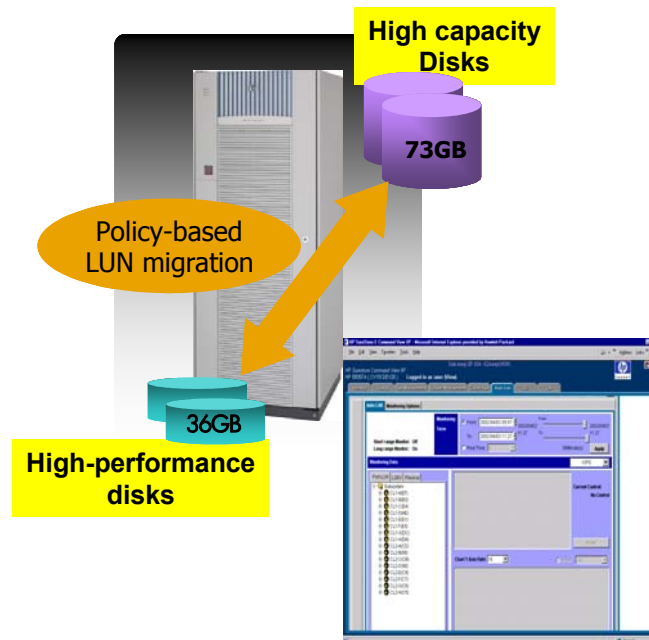
- New assignment of LUNs using drag 'n drop
- Assignment of multiple LUNs with single click
- Add/delete paths
- Checks each I/O for valid security
- LUN and WWN group control
- Integrated with Command View XP

Benefits

- Flexibility to configure the array to meet changing capacity needs
- Permission for data access can be changed with no downtime
- Every I/O is checked to ensure and maintain secure data access

Auto LUN XP

Auto LUN XP is a powerful management application that brings monitoring and tuning of the disk array XP system resources to a single desktop. It provides automatic or manual migration of XP storage volumes to fine-tune access for specific host and application needs. Auto LUN XP also offers full reporting capabilities that estimate the performance and capacity improvements that an organization will experience after migration — with virtually no impact on server/application resources.



Features

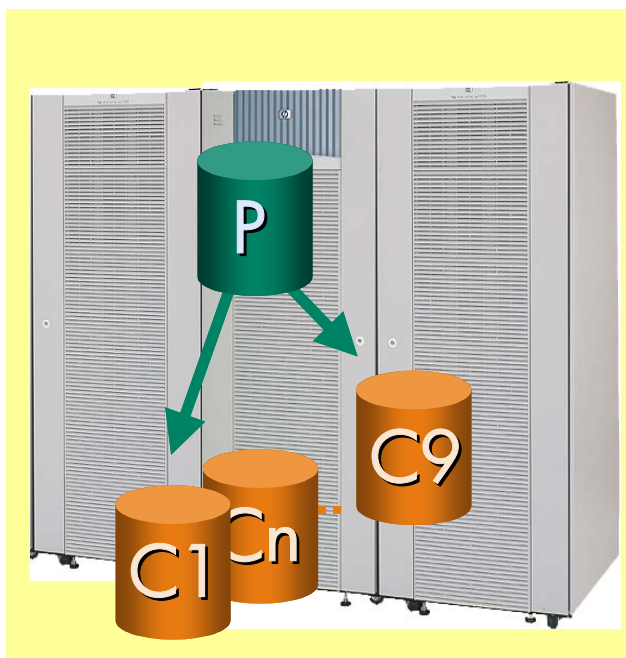
- Optimizes storage resources
- Moves high-priority data to underutilized volumes
- Identifies volumes stressed under high I/O workload
- Creates a volume migration plan
- Migrates data across different disks or RAID levels
- Integrated with HP Command View XP

Benefits

- Improves array performance and reduces management costs by automatically placing data in highest performing storage (cache-RAID 1-RAID 5)

Business Copy XP

Business Copy XP is a local mirroring product that maintains one or several copies of critical data. It allows customers to effectively leverage data to perform multiple mission-critical storage activities and to resolve a host of fundamental storage accessibility problems. It is a vital piece of the XP solution for applications such as offline backup, application testing, data warehousing, and decision support.



Features

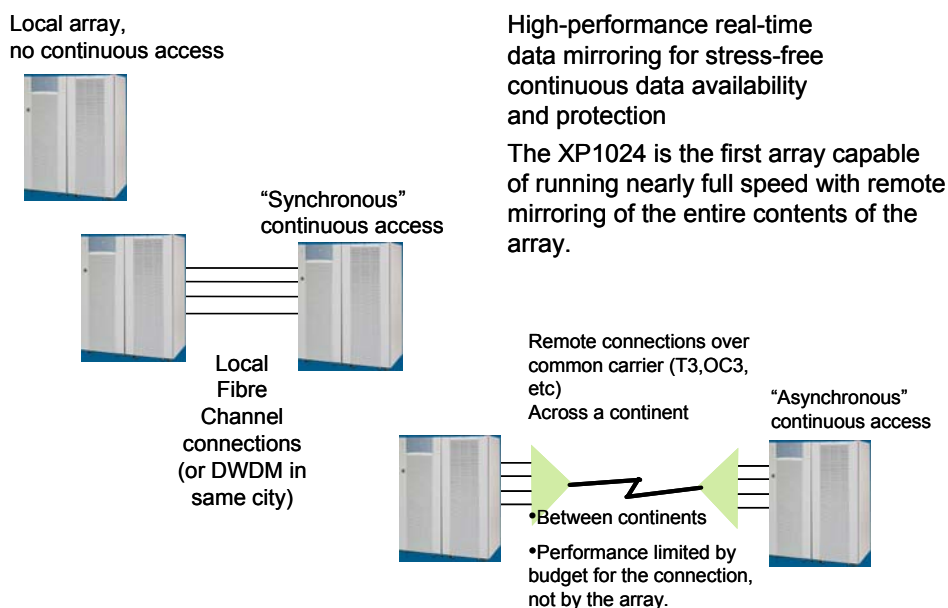
- Real-time local data mirroring within XP disk arrays
- Enables a wide range of data protection, data recovery, and application replication solutions
- Instant access to copy volumes
- Instant access to data restored from offline backup systems
- Flexible host agent for solution integration

Benefits

- Powerful leverage of critical business data for secondary tasks
- Allows multiple mission-critical storage activities simultaneously

Continuous Access XP and Continuous Access Extension XP

Continuous Access XP/XP Extension is a high-availability data and disaster recovery solution that enables real-time data mirroring between local and remote XP disk arrays. This wide range of remote mirroring solutions includes high-availability clustering as well as data migration and replication. Continuous Access XP provides the industry's only asynchronous copy-mode capability for rapid-response and long-distance failover.



Features

- Real-time remote data mirroring between local and remote XP disk arrays
- Enables a wide range of remote mirroring solutions
- Synchronous and asynchronous copy modes
- Connects using ESCON or Fibre Channel
- Fast failover/failback for seamless, reliable mirroring recovery operations
- Flexible host agent for solution integration

Benefits

- Reliable and easy to manage
- Offers a geographically dispersed disaster recovery solution

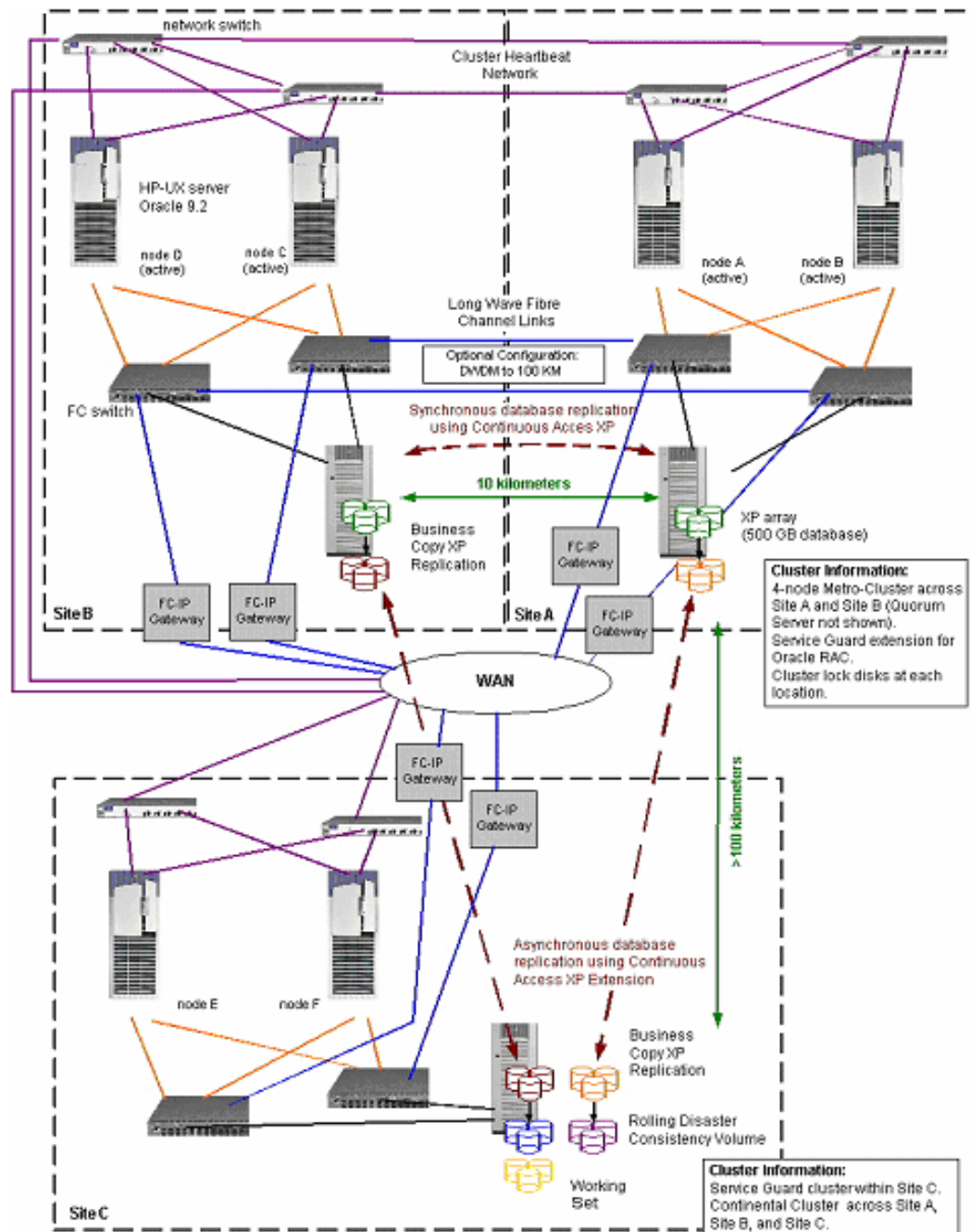
Multi-site disaster tolerant solution

Certain customers, typically those in the financial and government sectors, require the ability to continue critical operations after a local catastrophic site failure as well as maintain the ability to restart operations at a remote site should a regional catastrophic failure occur. The HP StorageWorks Multi-Site Disaster Tolerant Solution combines HP expertise in software, networking, hardware, and services to help customers recover application processing quickly and effectively—typically in less than one hour—should a local or regional disaster occur.

With this disaster recovery solution, HP provides mirrored XP arrays in two data centers close to user sites and a third array in an “out of region” data center. The solution uses the XP underlying remote copy feature for local, synchronous mirroring and long distance, and asynchronous mirroring to create redundancy and failover capabilities in case of a local disaster.

Two nearby sites—less than 100km apart—protect each other in case of a local disaster. Critical applications are mirrored synchronously to the second XP system, and in the case of localized failure, one site can take over application processing at virtually the exact point where it was interrupted. A third site located well outside the region offers protection should the two most preferred sites be lost.

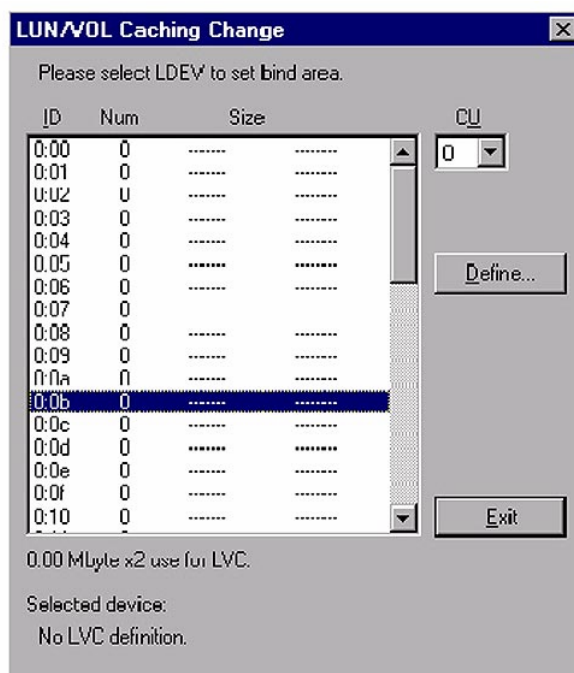
The software allows administrators to coordinate and automate synchronizing data transfers across the three sites. HP Consulting and Integration specialists can tailor HP management tools to a company’s specific environment.



Cache LUN XP

Cache LUN allows customers to lock certain blocks of data into a reserved section of cache within the XP disk array. This data remains locked in cache until users decide that they no longer need extremely fast access. This avoids the disk accesses and rotational latencies inherent in rotating magnetic media and takes advantage of the cache inside the XP product.

Cache LUN XP is ideal for customers who need to speed up access to mission-critical data, such as e-commerce databases or database indices. With Cache LUN XP, datasets are read directly out of cache without waiting for disk accesses and latencies, which saves processing time and reduces critical windows.



Features

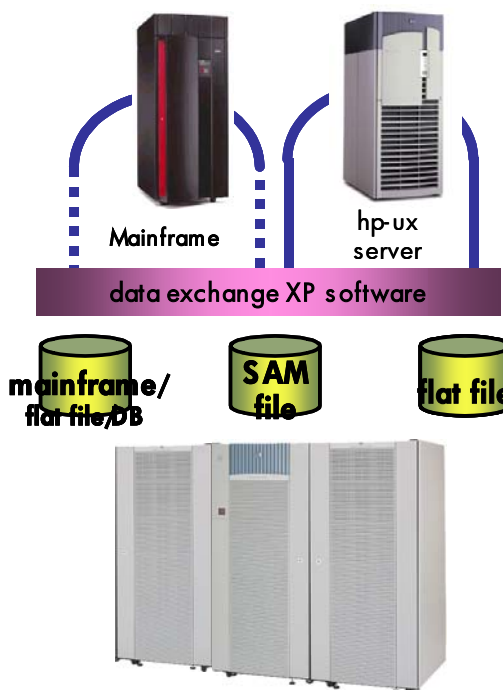
- Stores critical data in the XP array cache
- User configurable, easy to use
- Fast file access and data transfer
- Scalable
- Integrated with HP Command View XP

Benefits

- Speeds access to mission-critical data such as e-commerce databases
- Provides speedy access to critical data such as database indices in nanoseconds rather than milliseconds

Data Exchange XP

Data Exchange XP supports data sharing between different applications and systems. It enables the disk array to connect to a mainframe MVS system with an ESCON link. Data Exchange XP increases efficiency by keeping application servers at high-performance levels, while enjoying more flexibility and uptime in backup and data restore processes.



Features

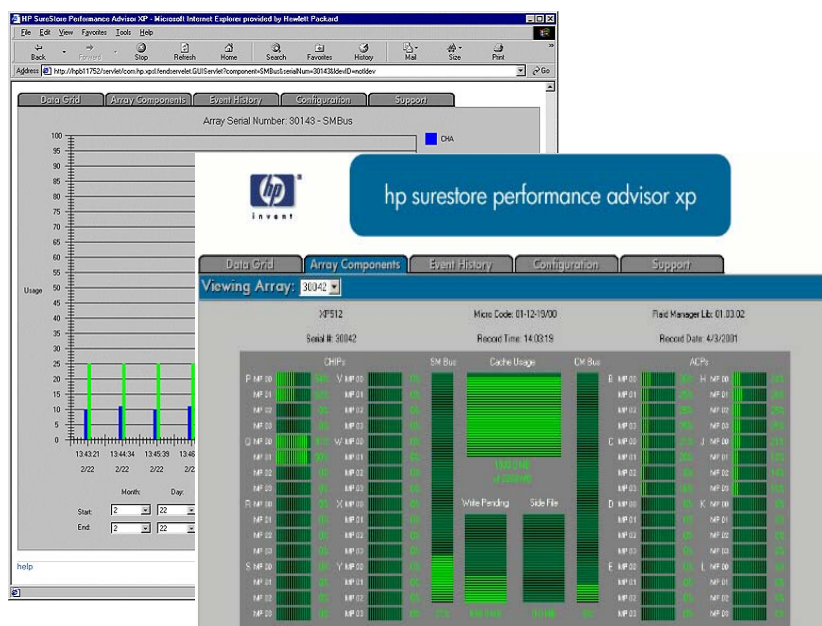
- Share data between mainframes and open systems servers
- Management and storage of mainframe and open systems data on single XP disk array
- Perform data format and code conversions

Benefits

- Consolidation provides optimized storage usage and management
- Savings in programming resources for data extraction and system-level resources
- Data can reside on XP storage in a common format, saving time and resources

Performance Advisor XP

Performance Advisor XP is an Internet-based application used to collect and monitor real-time performance of XP disk arrays. It consists of a management console, distributed host agents, and Web browser or command-line presentation clients. Data communication between these components is by XML, which enables the management station and browser-based clients to be located and monitored anywhere, at any time.



Features

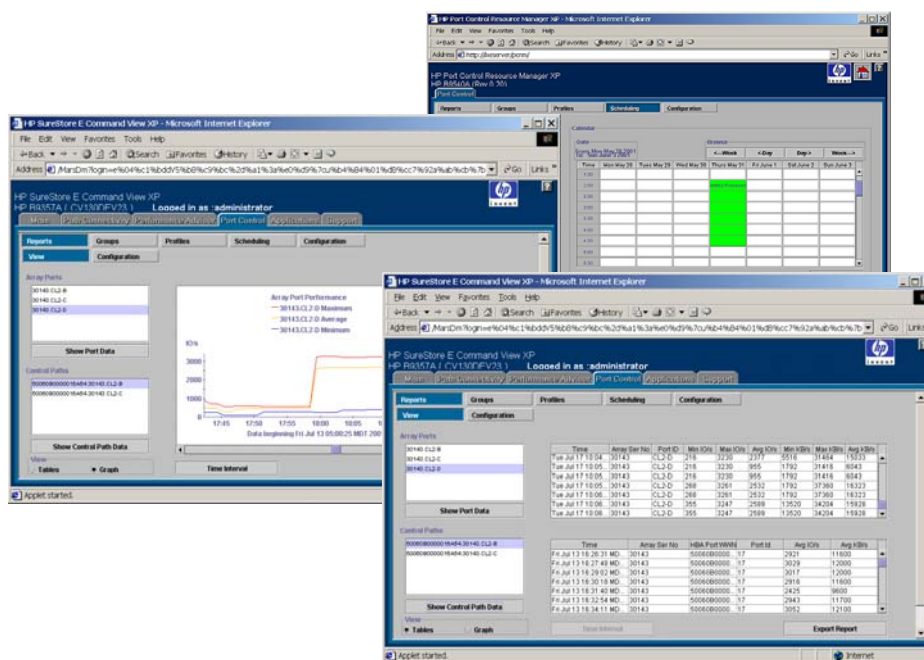
- Real-time data gathering and analysis
- Web-based integration with HP Command View XP
- System view of all resources
- Flexible event notification and large historical repository
- Displays up to 8000 LUNs
- Multi-operating-system support
- Key enabler for performance optimization service
- Integration with OpenView Storage Optimizer

Benefits

- Identify performance bottlenecks before they impact your business
- Helps maintain maximum array performance
- Precise integration eliminates “blame storming” across systems, database and storage administrators

Application Policy Manager XP

Application Policy Manager XP manages storage resources to maximize performance by prioritizing performance access between higher-priority and lower-priority systems. Users can better manage their XP disk arrays by prioritizing array performance based on the policies they define. This prioritization selectively restricts bandwidth to certain ports and hosts and enables full bandwidth to other higher-priority ports and hosts.



Features

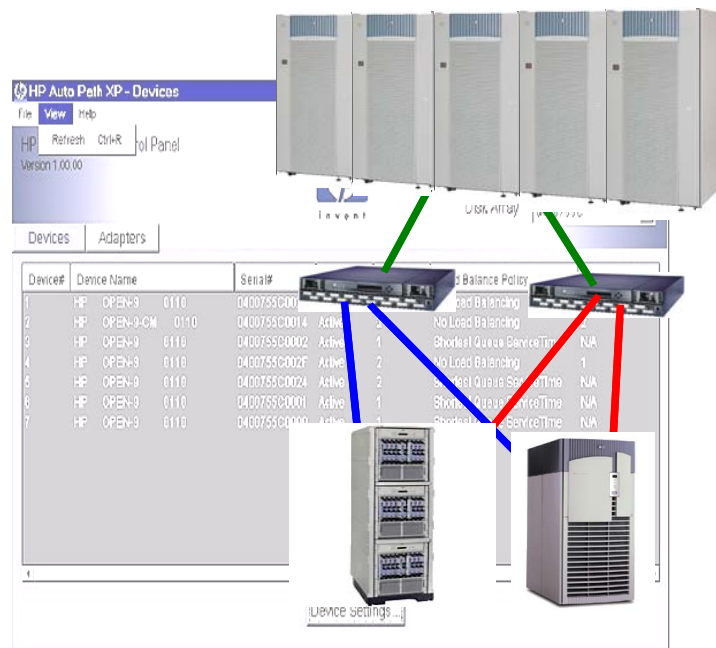
- Ability to set and relax host priorities by performance policies
- Configurable performance policies
- Schedule by hour or by day
- Reports and online graphing
- Scripting of tasks available from the command line interface (CLI)

Benefits

- Allows customer to align business priorities with the availability of array resources
- More efficient use of array bandwidth
- Allows for intelligent allocations of array resources for service-level oriented deployment

Auto Path XP

Auto Path XP provides automatic and dynamic I/O path failover and load balancing for host systems configured with multiple host adapters and connections to an XP array. This solution gives system administrators the ability to define and use multiple, redundant data paths for I/O between the server and its storage. It manages those paths automatically, ensuring that data is always available. It also distributes I/O across the defined paths, providing maximum I/O performance and ensuring that no single path is a bottleneck.



Features

- Automatic and dynamic I/O path failover and load balancing
- Automatic error detection
- Heterogeneous support
- Operating system support: Windows NT, Windows 2000; HP-UX, Linux, AIX
- Path failover and load balancing for MSCS, Windows NT, Windows 2000, Windows Server 2003

Benefits

- Eliminates single points of I/O failure
- Self-managing automatic error detection and load balancing
- Same software interface across XP and virtual arrays simplifies training and administration

Cluster Extension XP

Cluster Extension XP enables flawless integration of an XP disk array's remote mirroring capabilities with a wide range of high-availability server clustering solutions. It provides the broad benefits of asynchronous copy mode operations, fast failover and failback, and flexible volume management. As a solution, Cluster Extension XP delivers seamless and efficient operation, resulting in the highest performance, most reliable host or data center recovery solution available.

Features

- Extends leading high availability server clustering solutions over geographically dispersed data centers up to 10km
- Integrates XP remote mirroring with cluster monitoring and failover/fallback operations
- Provides continuous mirroring-pair synchronization monitoring and recovery
- Provides cluster server solutions for Solaris, AIX, and Microsoft Windows 2000
- Is tightly integrated with MC
- Supports ServiceGuard for HP-UX and Linux
- Supports DWM, ATM, IP, and WAN connectivity

Benefits

- Enhances overall solution availability
- Ensures continued operation in the event of metropolitan-wide disasters

Resource Manager XP

Resource Manager XP enables mainframe host connectivity via ESCON channel host processors on XP disk arrays. It allows for true resource sharing for mixed mainframe and open systems configurations. It also enables customers to consolidate their storage connection requirements among legacy, mainframe, and open systems.

Features

- Enables consolidation of mainframes together with open system servers
- Connects with an ESCON link and ESCON CHIP pairs on the array side

Benefits

- Reduces storage and storage management costs
- Enables storage consolidation and data sharing
- Provides more efficient use of storage resources

Pay per use for StorageWorks XP

Pay Per Use for StorageWorks XP (PPU XP) is a “pay as you go” storage solution that allows customers to select the appropriate storage configuration and software and then be charged monthly for the amount of storage that they use. HP metering technology tracks usage and enables customers to pay based on usage.

A technology-driven financial instrument, PPU XP is ideal for enterprises that want closer alignment of storage costs to business conditions, as well as for those facing uncertain capacity demands. With PPU XP, customers can

- Balance the risks and costs associated with investments in storage
- Avoid locking capital into storage infrastructure
- Allow for growth and change by providing flexible capacity, software, and technology upgrades.

Customers do not own anything—they share the investment risk with HP. Pay Per Use for StorageWorks XP makes sense when a company cannot afford to fall short on capacity and miss important business opportunities.

Customer challenges

- Flexibility to meet growth and surges in demand
- Application availability
- Storage scalability
- Rapid application deployment
- Ability to control and monitor storage utilization
- Simple, predictable business management
- High up-front IT investment

Why sell pay per use?

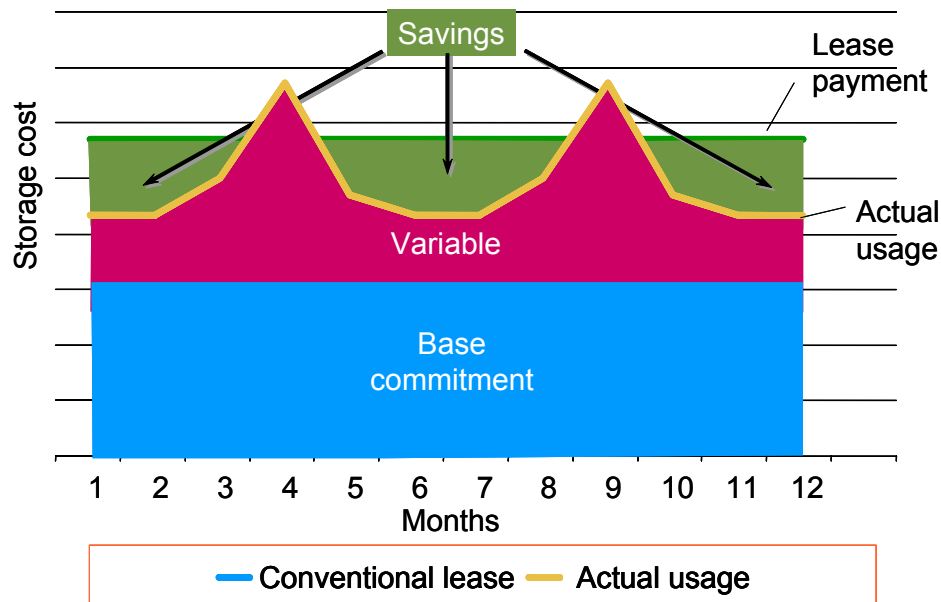
- Opens new doors
- Provides upsell opportunities for OpenView SAM and Managed Services
- Closes larger deals
- Meets market and competitive pressures
- Provides an opportunity with installed base of HP 9000 customers

Target customers

- Customer has peaks and troughs in utilization
 - Seasonal variation (for example, retail, financial)
 - Monthly peaks (for example, financial, payroll)
 - Daily peaks in Monday–Friday, 8 a.m.–6 p.m. operations
- Customer has demand or sizing uncertainty
- Customer's impact of not meeting service level agreements is high
- Customer wants to closely match costs with revenue or charge back usage to their customers

Pay for capacity only when you use it

XP PPU is designed for highly-volatile environments in which a utility meter tracks usage and enables customers to pay rent for actual usage. A highly flexible approach designed for dynamic demand, a customer pays a monthly base payment with daily usage peaks averaged into a monthly variable payment.



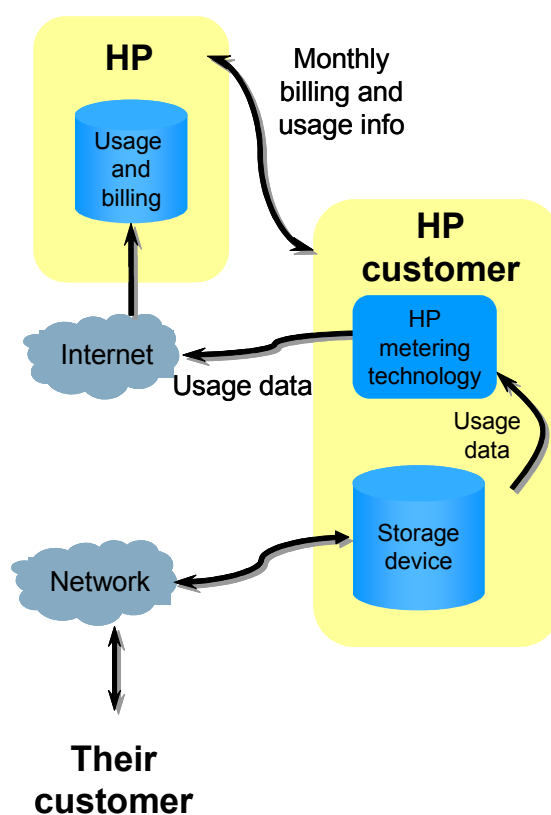
Note

PPU XP is an internal sales program that is available in North America and EMEA. Currently, it is **not** sold by partners and is currently classified as a “solution” and not as a “service.”

Traditional acquisition versus pay per use

	Traditional IT acquisition	Pay per use
Cost	Fixed assets	Computing resources are delivered at a price based on usage
Risk	<ul style="list-style-type: none"> Financial risk — IT cost structures are monolithic and fixed Hardware and IT capacity are not adjusted in real time 	<ul style="list-style-type: none"> Reduced risk because someone else owns the assets Sharing business risk because under-utilization means savings for the customer through lower payments
Agility	Cannot quickly adjust capacity or IT infrastructure cost structures or resources as business needs change	IT can respond instantly to business change

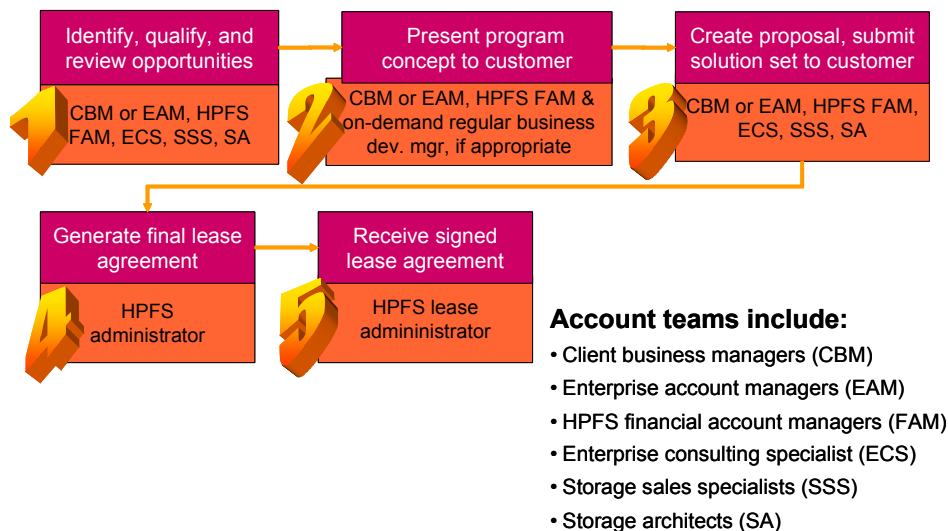
How PPU works



- Storage devices and metering technology physically reside at the customer's site
- Metering technology regularly measures the amount of configured capacity (capacity assigned to a port) and sends it to HP.
- Usage data is averaged and the customer receives a monthly bill.
- The customer can monitor and validate usage data.
- HP owns storage assets.
- Support contract is included.

5-step sales engagement process

As you can see, this is truly a cross-functional sell.



Therefore, it is imperative that HP and partners serve the unique and varied requirements of our customers and our sales team members administering this highly consultative sales process. The actual selling stages are similar to other HP solutions:

1. Evaluate and understand the customer's business and IT environment.
2. Develop plans linked to customer's business strategy and initiatives.
3. Establish buying vision with the customer by co-developing solutions that meet customer needs and reinforce HP as the "trusted advisor."
4. Resolve any concerns regarding the solutions approach and secure final commitment for solutions implementation.
5. Monitor implementation and ensure that customer expectations are met or exceeded for ultimate success!

Qualifying the customer

- Do you anticipate significant changes in storage requirements over the next 12 months?
- How do you measure allocated storage today?
- Are you getting the required information on storage use to effectively support your business?
- Do you have variable needs for storage?
- Are you currently using HP PPU for UNIX servers?
- Do you have capital spending constraints?
- How are you planning to acquire your storage? Cash purchase, lease, etc.?

Customer benefits of pay per use

- Simplifies capacity planning
- Pay for storage based on capacity usage
- Financial advantages of leasing
 - Reduces up front IT investment
 - Less frequent procurements
- Enhances alignment of costs with service levels
- Improves cash flow through better alignment of cost to revenue
- Reduces business risk
- Increases capacity to meet service level agreements
- Increases ability to adapt to ever-changing environment

When to sell XP and EVA

It is important to be thoroughly knowledgeable about the customer's application, server, SAN, and storage environment. It is also imperative to understand the customer's business needs, problems, perceptions, preferences, and biases. The more information you are able to gather, the easier it will be to lead with the product that is the best solution for the customer.

Sell XP when customer needs:	Sell EVA when customer needs:
Highest levels of availability	High scalability in a network storage design (modular architecture)
High scalability in a single platform (frame architecture)	High capacity utilization and efficient management
Broad and robust HP-UX solutions	Point-in-time copies with minimum capacity needs
Outstanding array management software	Autoload balancing and self-tuning performance
Broad disaster recovery solutions, CA synch and asynch and CASA	Lowest TCO
Broad consolidation solutions including HP-UX, OS/390, MPE/iX, Bull AIX, Fujitsu/Siemens UX, Linux, NetWare, SGI, Solaris, AIX, Windows/NT	Disaster recovery (CASA – see Module 9)
	HP-UX, NT/Windows, Linux, NetWare, OpenVMS, Tru64 UNIX, Solaris, AIX

Summary

XP customer characteristics

- Extremely high volumes of data (10–20TB)
- Need for extreme availability

XP target industries

- Telecom
- Manufacturing
- Retail
- Oil
- Defense
- Financial services

XP customer business needs

- Business continuity
- Data protection/disaster recovery
- Simplified/more efficient management

XP value proposition

The HP StorageWorks Disk Array XP provides large capacity, extreme availability, and high-end storage for mission-critical environments

Key features and benefits of the XP128 and XP1024 disk arrays

- **Controllable**
 - **Manageable** — manages many arrays from a single web-enabled console
 - **Serviceable** — replaces any component online with no interruption to applications or hosts
- **Resilient**
 - **Reliable** — provides extreme reliability and availability with redundant hot-replaceable processors, I/O interfaces, power supplies, batteries, and control processors

- **Extensible**

- **Open** — supports multiple operating systems including HP-UX, Linux, Microsoft Windows 2000, HP Open VMS, HP Tru64IX, NetWare, IRIX, and mainframes
- **Flexible** — supports mixed-disk environments and is backward compatible with 1-2Gb/s Fibre Channel, FICON and ESCON
- **Scalable** — scales up to 1024 disk drives or over 149TB (XP1024) and up to 128 disk drives or over 18TB of usable storage in a single array to accommodate growing storage needs

XP software portfolio

- Configuration management
 - Command View XP
 - LUN Configuration Manager XP
 - Secure Manager XP
 - Cache LUN XP
 - Resource Manager XP
 - Data Exchange XP
- Performance management
 - Performance Advisor XP
 - Application Policy Manager XP
 - Auto LUN XP
- High availability
 - Auto Path XP
 - Business Copy XP
 - Continuous Access XP
 - Continuous Access XP Extension
 - Cluster Extension XP
- Pay per use for XP program

Learning check

1. XP customers almost always have which of the following?
 - a. Extremely high volumes of data (10–20TB)
 - b. Need for extreme availability
 - c. Extremely high volumes of data (10-20TB) and need for extreme availability
 - d. Non-mission critical environments
2. The HP StorageWorks XP128 provides up to how much capacity?
 - a. 12TB
 - b. 18TB
 - c. 36TB
 - d. 72TB
3. The HP StorageWorks XP1024 and XP128 disk arrays support which of the following?
 - a. Mainframe operating systems only
 - b. Open system operating systems only
 - c. Fewer operating systems than the HP StorageWorks EVA
 - d. Both mainframe and open system operating systems
4. Business Copy XP is a _____.
 - a. Powerful management application that brings monitoring and tuning of the disk array XP system resources to a single desktop.
 - b. Local mirroring product that maintains one or several copies of critical data.
 - c. High-availability data and disaster recovery solution that enables real-time data mirroring between local and remote XP disk arrays.
 - d. A means of data sharing between different applications and systems.

5. Command View XP contributes to which of the following customer business needs?
 - a. Business continuity
 - b. Data protection
 - c. More efficient management
 - d. Disaster recovery
6. Customers who have a need for sharing data between mainframes and open system servers on a single XP disk array would benefit by which of the following?
 - a. Auto Path XP
 - b. Data Exchange XP
 - c. Business Copy XP
 - d. Application Policy Manager XP
7. A key differentiator between frame-based and monolithic arrays is that with a frame-based array a customer can do which of the following?
 - a. Support a maximum of two operating systems
 - b. Add array controllers and disk cabinets over time to increase storage capacity and performance
 - c. Support only mainframe systems
 - d. Convert to a monolithic solution
8. Characteristics of Pay Per Use for XP target customers include which of the following? (Select **three**.)
 - a. Seasonal variation in storage usage
 - b. Concern for risk of failing to satisfy service level agreements
 - c. Need protection against disasters
 - d. Would rather purchase than lease
 - e. Balances risks and costs associated with storage investment

9. The HP StorageWorks XP differs from the HP StorageWorks EVA5000 in that the XP _____. (Select **three**.)
- a. Offers heterogeneous operating system support
 - b. Provides disaster recovery solutions
 - c. Is based on a traditional storage architecture
 - d. Offers the highest levels of mission-critical support
 - e. Is a frame-based architecture
10. In an HP StorageWorks XP multisite disaster-tolerant solution, HP provides which of the following?
- a. Provides mirrored arrays in three regional sites within 30km of each other
 - b. Provides two data centers less than 100km apart
 - c. Provides mirrored arrays in two data centers close to user sites and a third array in an out-of-region data center
 - d. Provides two data centers less than 200km apart

Objectives

At the end of this module, students should be able to:

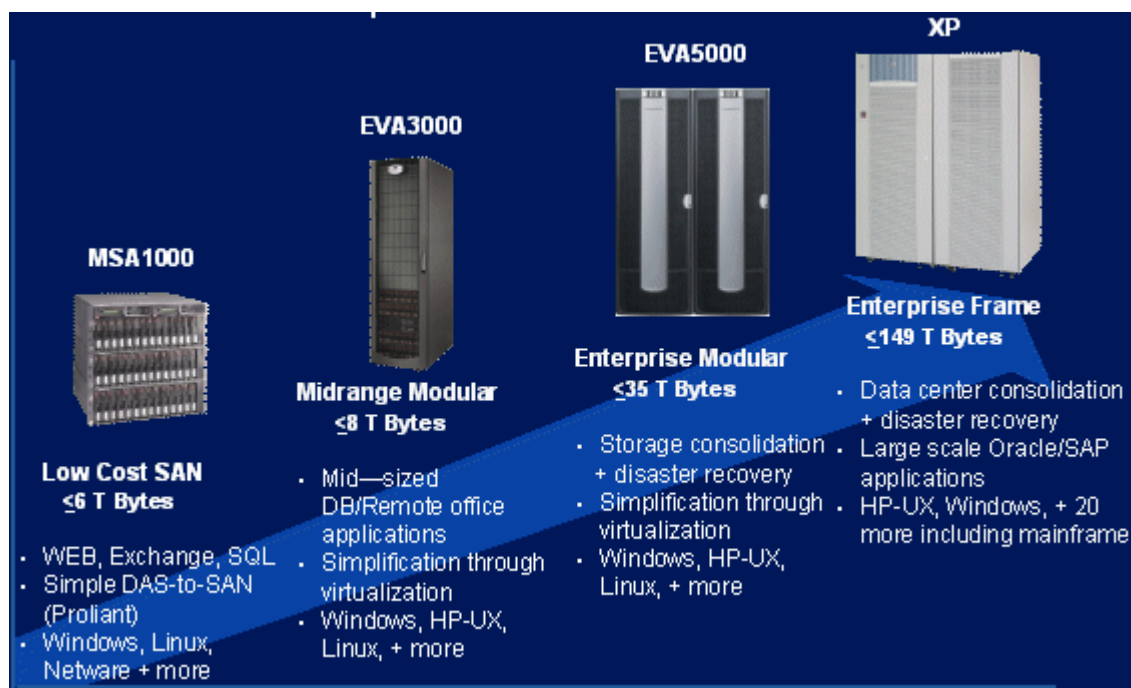
- Identify HP StorageWorks Enterprise Virtual Array family target customer characteristics and challenges.
- Describe the business value of the EVA family.
- Link EVA family features with business value.
- Describe EVA management components.
- Link qualifying questions with EVA family target market needs.
- Describe EVA system components.
- List EVA3000 and EVA5000 product characteristics.
- Describe the services solution portfolio.

HP StorageWorks Enterprise Virtual Array

This module covers the following products and components:

- HP StorageWorks Enterprise Virtual Array family
- EVA software management solutions
 - Storage Management Appliance
 - Virtualization Controller Software (VCS)
 - Storage Operations Manager
 - Command View EVA
 - Business Copy EVA
 - SecurePath
 - Storage Volume Growth
 - Continuous Access (CA)
- EVA system components
- EVA3000 and EVA5000 shared features
- Services solution portfolio
- Pay per use for StorageWorks EVA
- Configuring/ordering steps

HP StorageWorks subsystem array family



HP provides two categories of high-end storage for maximum choice:

- The HP XP provides modular storage for the very high end of the enterprise (Module 7).
- The HP StorageWorks Enterprise Virtual Array family, including the EVA5000 and the EVA3000, provide highly modular, scalable, and efficient heterogeneous storage for high and mid-range enterprises.

The EVA disk array family is an ultra-high-performance, ultra-high-capacity and ultra-high-availability “virtual” RAID (Vraid) storage solution for the mid and upper end of the enterprise marketplace that removes the time, space, and cost boundaries of traditionally designed storage.

The VA family continues to provide best-of-breed HP-UX solutions, but, over time, the VA family will consolidate into new EVA-based mid-range and entry-level versions.

The entry-level MSA1000 continues the investment protection that is inherent in the DAS-to-SAN (DtS) solution for HP ProLiant servers.

Competitive positioning vs. EMC



EVA target customer characteristics

The EVA3000 and EVA5000 are designed to meet the needs of different segments of the marketplace.

EVA5000

The EVA5000 is designed for the data center where there is a critical need for improved storage utilization and scalability while meeting application-specific demands for high-transaction I/O and data rate performance, seamless capacity expansion, instantaneous replication, and simplified storage administration.

EVA5000 meets the needs of customers who are typically looking for:

- **High storage utilization** — large capacity requirements and the need for storage efficiency
- **High performance** — more demanding applications (such as online transaction processing) that require consistently high transaction I/O and data rate performance
- **High availability** — mission-critical applications (where there is a significant impact on revenue) and enterprise class data centers
- **Simplified storage management** — need to efficiently configure, manage, and maintain storage resources and to do more with fewer resources

Typically, these customers can be found in environments with:

- Frequent data replication
- Storage capacity requirements up to 70TB
- An existing Fibre Channel SAN or those looking to move to a SAN
- Explosive data growth and a requirement for consolidation of disk resources
- Large IT budgets, but are looking for effective use of storage resources
- Shrinking backup windows due to increasing demands on storage resources
- The need to reduce IT expenses through consolidation of storage

EVA3000

The EVA3000 provides improved storage utilization and scalability while meeting application-specific demands for consistently high-transaction I/O and MB data rate performance, seamless capacity expansion, instantaneous replication, simplified storage administration, and cost-effectiveness.

EVA3000 meets the needs of:

- Medium to large corporate customers who need a reasonably priced Fibre Channel solution
- Customers with storage requirements greater than 1TB, but less than 8TB and are not expecting to grow beyond that within 2–3 years
- Customers with high availability mission-critical applications (where there is a significant impact on revenue)
- Customers who require outstanding performance

When selling to these customers, keep the following in mind:

- Sell as a primary-tier storage utility in smaller data centers.
- Sell as a second-tier storage utility within the enterprise.

Typically, these customers can be found in environments with:

- The need to simplify storage environment management
- Shrinking backup windows due to increasing demands on storage resources
- The need to eliminate back-up windows and reduce recovery time with disk-based backup and replication
- Existing Fibre Channel SAN environments or those looking to move to a SAN

Target industries

Customers who require high utilization, high performance, high availability, and simplified storage management are found in the following industries:

- Banking, finance, online brokerage
- Large corporate customers
- Scientific organizations
- Governmental organizations and departments
- ISP, SSP, web, and application hosting
- Media, broadcasting, entertainment
- Data warehousing
- Medical imaging

Target customer challenges

Specific challenges that EVA target customers face include:

- **Business continuity** — Protecting business operations from major interruptions is one of the most critical issues facing many customers. Continuity of business processes is very important for customers who have business-critical databases and applications, and 365x24 business operations. These customers need highly accessible data.
- **Consolidation** — EVA target customers need to efficiently configure, manage, and maintain storage resources. They need efficient storage utilization (online and nearline).
- **Heterogeneous support** — Customers need centralized data and flexible storage capacity and efficiency for data across a variety of operating systems.
- **Database growth and recovery** — Customers need to offload the network traffic associated with storage access onto the separate network to effect lower latency, more efficient resource utilization, and significantly faster data speeds. EVA target customers need improved uptime and access to data as well as faster application deployment.
- **Need for operational efficiencies** — Protecting storage investments and reducing IT staffing costs are primary concerns of most customers. EVA target customers need more efficient storage management, automation, and simplification of management tasks.

EVA family business value

The EVA StorageWorks RAID array family offers end-to-end 2Gb/s Fibre Channel (FC) performance and virtualization technology.

You may recall the HP storage business value model that we discussed in Module 2. There we talked about how storage solutions can provide business value in terms of operational efficiencies, service levels, and business flexibility. The EVA family business value is summarized in the following terms:

- **Improved operational efficiencies** — The EVA family offers customers savings on their total cost of ownership. With EVA, customers realize improved operational efficiencies in several areas. They save on staff costs and increase the capacity utilization of the storage system. Overall, customers realize a more efficient use of assets.
- **Improved service levels** — EVA customers derive value from increased service levels. Specifically, offloading storage traffic from the enterprise network and increasing data speeds result in greater availability of applications and data. The ability to service greater numbers of customers and users adds value. EVA products also protect business operations from major interruptions as a result of unexpected downtime.
- **Increased business flexibility** — EVA enables customers to add more storage quickly, thereby reducing planned downtime. This capability also provides a more timely response to user and application growth, resulting in increased business flexibility and competitive responsiveness.

In the next section of this module, we will show how EVA features deliver on these three components of business value.

Improved operational efficiencies

Four unique features contribute to improved operational efficiencies and reduced total cost of ownership (TCO) for the enterprise storage customer. Together, these features enhance bottom-line profitability:

- Modular architecture
 - Vraid
- High-density architecture
- Higher utilization through virtualization
 - Space-saving Vsnapshots
- Combined hardware/software management solution — provides a centralized point for configuration, management, and monitoring of storage elements

Another way of explaining operational efficiencies is to say that EVA provides space, time, and cost savings. The following pages examine each of these features in terms of space, time, and cost savings.

Modular architecture

The EVA family uses a modular design of networked components, so customers buy only what they need when they need it.

EVA5000

General-purpose EVA5000 models	Drive bays	Maximum drive capacities (GB)		
		36GB	72GB	144GB
2C2D-C	28	1.0TB	2.0TB	4.0TB
2C6D-C	84	3.1TB	6.2TB	12.2TB
2C12D-C	168	6.2TB	12.3TB	24.5TB
2C12D-C plus expansion cabinet	240	8.7TB	17.5TB	35.0TB
(2) 2C12D-C plus expansion cabinet	480	17.5TB	35.0TB	70.0TB
High-end technical computing EVA5000				
8C8D-C	112	4TB	8TB	16TB

- Up to 24.5TB (168 drives) can be configured per cabinet along with a pair of HSV110 controllers and 3U additional space for options.
- Up to 35TB (240 drives) can be configured in two cabinets (using a 2C12D-C model and an expansion cabinet).
- Up to 70TB (480 drives) can be configured in three cabinets (using two 2C12D-C models and an expansion cabinet).

EVA3000

EVA3000 models	Drive bays	Maximum capacities (GB)	
		72GB	146GB
2C2D-C models	28	2.0TB	4.1TB
2C2D-C with 2 optional drive enclosures	56	4.1TB	8.2TB

The EVA3000 is available in one of four integrated “independent bundle” configurations. Each bundle includes

- One pair of HSV100 controllers
- Two FC drive enclosures
- 8 to 16 integrated FC hard drives — varies by bundle

The choice of rack is broader. EVA3000 independent bundles are factory integrated in a choice of EVA cabinet (22U, 36U, 42U) or rack system/E rack systems (25U, 33U, 41U). Configured solutions provide support for the most popular multivendor operating system platforms and stringent data center availability enhancements such as multi-pathing and clustering.

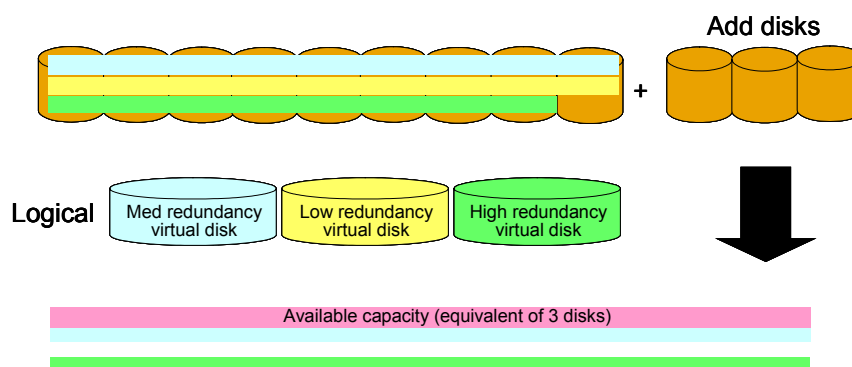
High-density architecture benefits

The modular, high-density packaging of the EVA family leads to operational efficiencies and improved asset management, specifically:

- Reduction in required data center space
- Consolidation of servers and storage
- Significant reduction in maintenance and management costs
- Better use of human resources: free up people to invest in growing the business



Vraid — easily add disk space as needed



Automated virtual disk placement and management by attributes

Another aspect of modularity is the ability to easily add disk space as it is needed. Vraid automatically redistributes virtual RAID sets when new disk capacity is added, therefore eliminating tedious, manual volume management. Vraid also increases performance via load balancing, a benefit we will discuss later in this module.

By comparison, a traditional RAID set may be limited to fewer striped disks due to the work involved in expanding the RAID set. Because Vraid stripes data across all the disks within the disk group, it provides higher performance than traditional RAID.

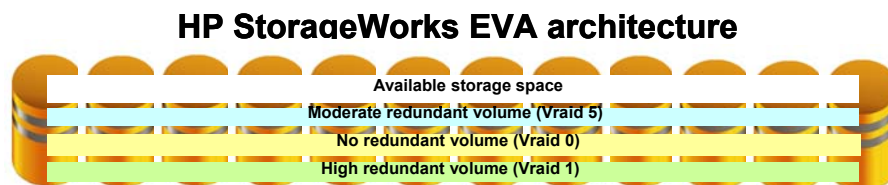
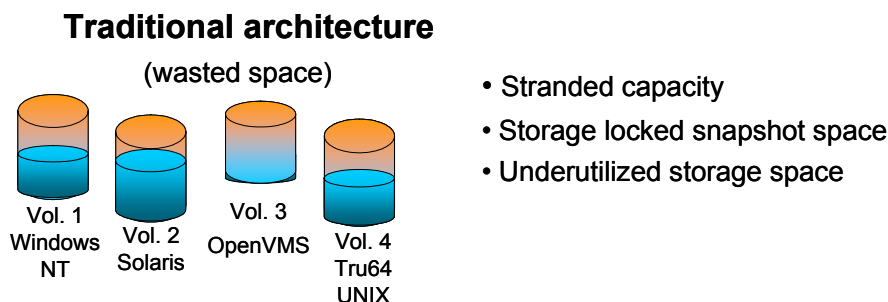
How Vraid works

Virtual RAID helps determine the level to which user data is protected—VraidX, where X can be 0, 1, or 5. Virtual RAID differs from traditional RAID because the data is spread across all of the physical disks in the pool. There are three types of redundancy available with the EVA storage system:

- **Vraid0**, or striping, is optimized for speed and virtual disk size, but has no inherent redundancy. A striped virtual disk is one whose data to and from the host is broken down into segments and distributed on the disks comprising the disk group from which the virtual disk was created. Reading and writing to a striped virtual disk is very fast and makes the fullest use of the available storage.
- **Vraid1**, or mirroring, gives the highest level of data protection. All data blocks are written twice on separate physical disks. For read requests, the block can be read from either disk, which can increase performance. Mirroring takes the most storage space because twice the storage capacity must be allocated for a given amount of data. In fact, Vraid1 behaves like Vraid 1+0, in that it does mirroring and striping.

- **Vraid5**, or parity striping, offers a balance of speed, size, and redundancy. A striped virtual disk is one whose data is broken down into segments and distributed on the physical disks included in the disk group in which the virtual disk was created. Each set of data segments has another segment, called a parity segment, appended to it. If one of the data segments becomes corrupted, the data can be reconstructed from the parity segment and the remaining data segments.

Higher utilization through virtualization



We discussed the benefits of virtualization compared to traditional architecture in an earlier module. The EVA offers significantly higher utilization through virtualization, so customers can utilize more of the storage that they purchase. There is no need for over-provisioning. Users can dynamically expand disks as applications grow.

And, as we will see in the next section, the customer does not have to buy a lot of extra disk space for snapshots.

Space-saving Vsnap

Virtually capacity-free snapshots (Vsnap) help customers use storage space more efficiently. With Vsnap, the storage system does not reserve capacity for the snapshot volume in advance. Whereas traditional solutions require duplicate-sized space reserved for a snapshot, the EVA grabs space only as needed. With Vsnap, there is no need for the customer to purchase large amounts of storage for replication space.

Virtualization controller software supports two types of snapshots: standard snapshots and Vsnap. VCS supports individual snapshots of multiple virtual disks, the number of which is limited by the number of virtual disks (LUNs) (maximum 512). VCS also supports multiple snapshots of a single virtual disk.

- In a Vsnap, the space on the Vsnap volume is used only as the original virtual disk's data changes. The Vsnap's volume is a new virtual disk (LUN) that initially shares the original virtual disk's pointer-based entries. As the original virtual disk is written, free space is consumed as necessary to preserve the original contents of the Vsnap.

The Vsnap is especially useful because capacity is taken *only* when it is needed. This prevents large amounts of space from being locked away and unavailable as with traditional snapshots. A significant feature of Vsnap is that it can be created from any level of redundancy (Vraid0, 1, or 5).

Vsnap are intended to be short-lived snapshots. Their creation is fast because they do not require disk allocation, but their size grows dynamically and may eventually run out of storage capacity. In this case, the Vsnap becomes inoperable.

- In a standard snapshot, a set amount of capacity equal to the original volume is reserved for the snapshot. Data is not written into that reserved space until necessary. As the data changes in the original virtual disk, the data in the snapshot volume is updated with the original data. Customers can choose to make a standard snapshot when they want to ensure that the space is reserved.

Standard snapshots do not grow in size; therefore they are the preferred choice when long-lived snapshots need to be created.

Improved operational efficiencies summary

Let's review the features that contribute to improved operational efficiencies and greater bottom-line profitability:

- Modular architecture allows customers to buy only what is needed when it is needed.
 - Vraid easily adds disk space when needed.
- High-density architecture reduces required data center space.
- Higher utilization through virtualization means that customers use more of the storage that they purchase.
 - With space-saving Vsnapshots, there is no need to buy extra disk space for snapshots.

Improved service levels and increased business flexibility

The second and third components of the business value model are service levels and business flexibility. Three important EVA features contribute to improved service levels and increased business flexibility for the enterprise storage customer:

- Outstanding performance
 - Vraid storage pool load leveling
- Enterprise-class availability
 - No single point of failure
 - 365x24 application availability
 - Distributed sparing
- Virtually instantaneously available snapclone

These EVA features deliver value from improved availability and minimized downtime which can improve service levels, application performance, and provide support for additional users. EVA also provides increased business flexibility by speeding application deployment and user access to data.

We will examine each feature on upcoming pages.

Outstanding performance

Performance is one of the most important benefits that can be derived from virtualization at the storage system level. The most common source of performance improvement is load balancing through the elimination of hot spindles, or hot drives. A hot spindle is a drive that is being subjected to intense I/O loads because either the data it contains is frequently accessed, or it is heavily worked due to the type of RAID employed.

Virtualization allows data to be spread across more spindles, dramatically improving performance. Disks no longer need to be arranged in traditional RAID sets by disk capacity size and type of RAID protection.

Instead, a “virtual” disk is defined, drawing its capacity from a designated pool of storage. Because of storage pooling virtualization, the EVA is able to support multiple virtual disks of varying capacity and RAID types within a single storage pool (known as a disk group). In addition, all virtual disks in a pool can spread their capacity across all the physical disks that contribute to that pool.

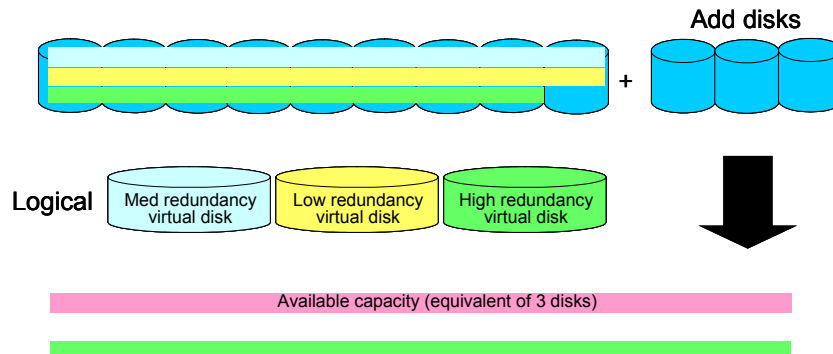
For example, a traditional RAID 1 (mirrored) configuration for 36GB of data space, requires two 36GB disks to be assigned as RAID 1. So when the data, which might be in a high performance application, is read or written, there are only two disks involved, thus limiting performance. With virtualization, this same 36GB RAID 1 requirement will be spread across 4, 6, 8, or more disks in a pool. Performance can be greatly improved because more spindles are simultaneously involved in larger transfers.

Performance details

The measured sustained I/O and MB throughput of the EVA5000 and EVA3000 are as follows:

- **EVA5000** — up to 168,000 IOPS and up to 675MB/s throughput per controller pair
- **EVA3000** — up to 162,000 IOPS and up to 335MB/s throughput per controller pair

Vraid storage pool load leveling



Automatic, transparent data redistribution to optimize performance

1–16 disk groups per EVA

Earlier in this module, we discussed Vraid and its ability to add disk space or capacity when needed. Vraid also increases performance in that it provides automatic, transparent data redistribution, which results in improved performance.

Vraid allows data to be redistributed across physical disks within a storage pool if there is a change to the virtual disk data or pool structure. This process redistributes each virtual disk's blocks evenly across as many spindles as the virtual disk's redundancy type will allow.

If an activity occurs that causes a change to the virtual disk data or pool structure (such as the addition of new capacity), the dual HSV controllers can use an on-the-fly load-leveling algorithm to balance performance without interrupting ongoing client workloads. This process redistributes each virtual disk's blocks evenly across as many spindles as the virtual disk's redundancy type will allow.

Virtual disk load leveling and dynamic expansion without application downtime increases application availability and performance.

Enterprise-class availability

The EVA improves service levels through increased availability. We will examine three aspects of availability:

- No single point of failure
- 365 days a year, 24 hours a day (365x24) application availability
- Distributed sparing

No single point of failure

EVA's redundant architecture and value-added software eliminate single points of failure from server to storage in clustered or single server configurations with multipathing. Features and capabilities include:

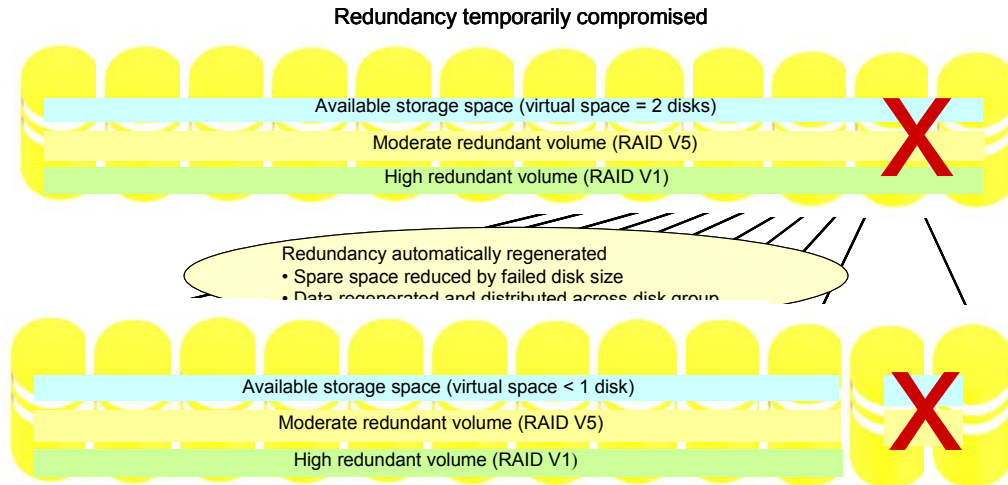
- Mirrored cache, dual redundant controllers and paths
- Backplane eliminated by networking components
- Multibus failover using HP StorageWorks SecurePath
- SMART monitoring
- Vraid medium- or high-data redundancy

365x24 application availability

With EVA, applications are available 365 days a year, 24 hours a day.

- No storage reconfiguration downtime: users just plug in the disks and add to the disk group
- No downtime caused by running out of disk space: users just expand the virtual disk
- Nondisruptive, faster backup/restore operations: virtual snapshots and snapclones eliminate backup windows

Distributed sparing for rapid restoration of performance



Distributed sparing of disk capacity provides faster rebuild times in the event of device failure, thereby restoring performance and improving availability.

VCS can be configured to hold back enough pool space across multiple spindles to spare an optimal number of drives per pool depending on the application. This spare space is then used to restore redundancy to virtual disks that have segments mapped to a disk drive that fails. If a drive fails, VCS will initiate a background process that rebuilds Vraid1 or Vraid5 data into the spare space that was held back from the pool. If a Vraid0 virtual disk has blocks on a drive that has warned of imminent failure, the data from that drive will be copied directly to spare space.

Distributed sparing works with an algorithm similar to leveling, except the goal is to empty the failed or failing drive rather than level its usage with the other drives. Data is striped across multiple spindles so data can be rebuilt faster because more spindles can access the data simultaneously than with a conventional spare.

Virtually instantaneously available snapclone

Virtually instantaneous snapclones add to improved service levels and business flexibility by enabling data to be available almost immediately, even while a clone is being built. A snapclone gives the customer an immediate point-in-time clone of a virtual disk that can be immediately accessed for reading *and* writing.

Virtually instantaneous snapclones are the best option for creating a long-term preservation of a copy or a series of copies of a virtual disk for data mining or application testing. All data is copied into the reserved space proactively so the result is two identical copies of the data, at the redundancy level of the original volume.

This process is unlike traditional cloning methods where the clone copy is not available until the copy is complete. As the virtually instantaneous snapclone is being created, the controller is able to access the original virtual disk for the data and keep track of what data has changed since the moment the virtually instantaneous snapclone was taken.

A snapclone should reside on a different disk group and be accessed by a different controller.

EVA family business value summary

Let's review the EVA business value proposition and the key features that deliver that value.

The EVA creates impressive value opportunities within a customer's enterprise in the areas of improved operational efficiencies, improved service levels, and increased business flexibility.

These key features deliver operational efficiencies:

- Modular architecture
- High-density architecture benefits
- Vraid capacity expansion
- Higher utilization through virtualization
- Space-saving Vsnapshots

We also examined three important features that contribute to improved service levels and increased business flexibility for the enterprise storage customer:

- Outstanding performance including Vraid storage pool load leveling
- Enterprise-class availability, including no single point of failure, 365x24 application availability and distributed sparing
- Virtually instantaneously available snapclone

EVA management components

This section examines the management of the EVA beginning with hardware — the management appliance — and continuing with software. The following software components are covered:

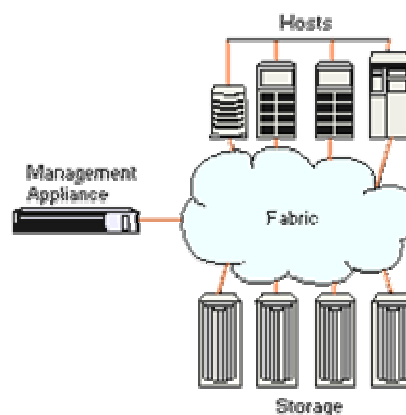
- **VCS** — Virtualization Controller Software
- **Storage Operations Manager** — expanded storage management software for EVA
- **Command View EVA** (formerly called HSV Element Manager) — GUI interface for management and monitoring
- **Business Copy EVA** (formerly known as Enterprise Volume Manager) — local data replication software for faster backups/restores (data replication within an array)
- **SecurePath** — failover support from the host to storage
- **HP OpenView Storage Volume Growth** — *Host-based* software used to enable Windows 2000/Windows Server 2003 platforms to recognize EVA-based volume expansion
- **Continuous Access** — remote data replication software (data replication between arrays)

Management Appliance

The HP OpenView Storage Management Appliance III is a combined hardware and software solution that provides a centralized point for configuration, management, and monitoring of storage elements, including switches and storage devices, while simplifying management tasks and reducing cost. It offers a comprehensive and cost-effective configuration, monitoring, and storage management solution for the multiple platform SAN. Designed to connect directly to a SAN fabric, the Storage Management Appliance is a host-independent system that performs management functions without requiring host computers.

HP OpenView Storage Management Appliance software

HP OpenView Storage Management Appliance software v2.1 is a centralized, appliance-based monitoring and management interface for the Open SAN. Storage Management Appliance software provides a web-based entry point for centralized storage management. This intuitive interface allows the user to organize, visualize, configure and monitor storage from a single navigation point on the SAN. It provides a launch site for a variety of value-added HP storage management applications as well as popular data and virus protection products, and provides navigation links to directly manage storage devices.



Note

The HP OpenView Storage Management Appliance III comes factory-installed with Storage Management Appliance software, which includes Command View EVA.

Management Appliance enhancements

Management Appliance provides the following enhancements:

- Provides a more streamlined (1U) profile integrating a faster processor, more memory, greater disk capacity, and a 2GB Fibre Channel host bus adaptor (HBA) for a higher performing SAN management platform
- Provides required hardware platform for HP OpenView Storage Operations Manager v1.0, offering comprehensive storage resource management for HP StorageWorks Enterprise Virtual Arrays (EVAs) and heterogeneous network storage devices

The following table compares the Storage Management Appliance III with the previous model.

Functionality	Management Appliance II	Management Appliance III
Processor	Intel Pentium III 1.26 GHz	Intel Xeon 2.40GHz
Memory	1GB	2GB
Disk capacity	2–18.2GB	2–72.8GB
Host bus adaptor	LP8000	HP FCA2355
Remote management	Remote Insight Lights-out Board	iLO advanced package
Optical drive	CD-ROM	DVD-ROM
Form factor	2U	1U
Factory installed image	Management Appliance 1.0C software update	Appliance software v2.1

Key features include:

- Security

- Three levels of authorization enable role-based, privileged access: administrator, operator, and user.
- Authentication by user name ensures detailed audit trails.
- Support of virus protection software decreases vulnerability to attacks.
- SSL encryption and HTTPS support ensures data transmission privacy.

- Availability

- Dual redundant SAN is supported with one appliance.
- Configuration support enables quick recovery in case of fatal appliance outage.

- Application support

The Storage Management Appliance core applications include HP OpenView Storage Management Appliance software, Command View (GUI interface), and HP management agents. The supported layered applications include:

- Business Copy (discussed in upcoming pages)
- SecurePath (discussed in upcoming pages)
- Storage Provisioner (discussed in Module 14)
- Industry-standard virus and backup software
 - ◆ McAfee NetShield
 - ◆ Symantec Norton Antivirus
 - ◆ Veritas Backup Exec
 - ◆ Legato NetWorker
- HP Proactive Remote Service is available **free** for customers who have already purchased a hardware service contract for their SAN devices. The event system that is integral to the Storage Management Appliance software is tightly integrated with Proactive Remote Service available to hardware customers.

Virtualization Controller Software

The HP StorageWorks Enterprise Virtual Array is initially configured with the EVA system software preinstalled. The software contains Virtual Controller Software, Environmental Monitoring Unit (EMU) firmware, programmable component images, diagnostics, and message files.

Virtualization Controller Software enables virtual RAID capabilities that:

- Improve performance
- Increase disk utilization efficiency
- Dynamically expand storage capacity

VCS features include:

- Complete 2Gb/s end-to-end Fibre Channel solution
- HSV110 controllers using VCS provide support for
 - EVA5000 — up to 168 drives per 42U EVA cabinet. An expansion cabinet increases the support up to 240 disk drives per controller pair.
 - EVA3000 — up to 56 disk drives per controller pair.
- Up to 512 virtual disks
- Vsnapshots and snapclones are optional, enabled by a software license key

The optional VCS snapshot version must be ordered to support advanced functions such as virtually instantaneous snapclones, virtual capacity-free snapshots, or traditional snapshots (Business Copy)
- VCS 3.0 supports Continuous Access (CA) for long distance replication or array-to-array replication and Business Copy for local replication or within an array replication
- Dynamic capacity expansion
- Distributed sparing of disk capacity

EVA supports 36GB, 72GB, and 146GB 10K rpm and 36GB and 72GB 15K rpm dual-ported 2Gb/s FC disk drives at full rated transfer rates.

Storage Operations Manager

HP OpenView Storage Operations Manager offers system administrators a comprehensive, easy-to-use solution for proactively managing EVA arrays and a variety of networked storage devices through a consolidated view.

HP OpenView Storage Operations Manager is an efficient and robust EVA array and SAN management solution. It provides a central management console from which EVA arrays plus heterogeneous storage are automatically discovered, mapped, monitored, maintained, and configured. Heterogeneous storage that Storage Operations Manager can manage includes infrastructure (switches, HBAs, bridges), direct attached storage (DAS), networked attached storage (NAS), and tape storage devices

HP OpenView Storage Operations Manager combines EVA array management with Command View EVA v3.1 and heterogeneous SAN management with HP OpenView Storage Node Manager into a single orderable product with consistent capacity-based licensing. HP OpenView Storage Operations Manager is required software to manage EVA arrays beginning with EVAs with VCS 3.010.

What's new

Integration with HP Systems Insight Manager provides a single point of access for managing the Enterprise Virtual Array along with other HP devices. This integration enables the use of many of the core services of Systems Insight Manager in a single console providing unparalleled breadth of device management for HP servers, clients, storage, power, and printer products.

Key features and benefits

- Expanded SAN storage management software for EVAs. Helps customers economically manage EVAs across distributed multivendor SAN, NAS, DAS, and tape. Enables EVA customers to readily take advantage of OpenView Storage Area Manager software to improve efficiency, reduce costs, and simplify management of their networked storage infrastructure.
- Supports the Storage Networking Industry Association (SNIA) Standard Management Initiative Specification (SMI-S) v1.01 with an SMI-S provider specific for EVA arrays, which “facilitates standards-based technology adoption and simplifies management.”
- Includes foundation for the HP OpenView Storage Area Manager V3.1 software. Enables customers to easily take advantage and try more advanced storage resource management functions for managing capacity growth, increasing service levels, and managing performance and capacity utilization with additional OpenView Storage Area Manager modules.

Command View EVA

Virtualization Controller Software is managed through a GUI interface called Command View (formerly called HSV Element Manager) that runs on the Management Appliance and is accessed by a web browser. Command View supports internet browsers and logical views of the enterprise virtual array. A single Management Appliance can manage up to 16 EVA storage systems (16 HSV110/HSV100 controller pairs).

Command View EVA is required to operate the EVA5000 with VCS media kit. The Command View EVA software is sold separately from the VCS kit.

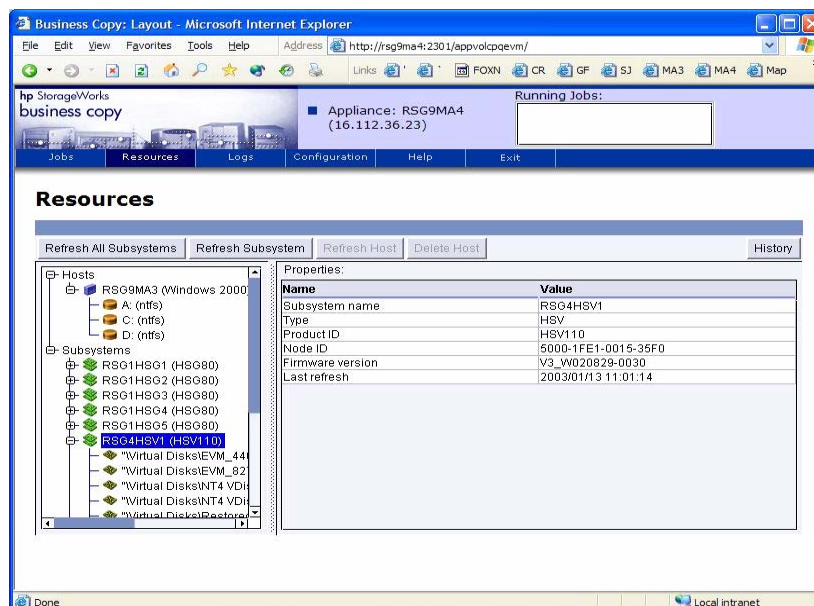
Note

The EVA5000 does not operate without Command View V3.1.

The user interface to the EVA3000 and EVA5000, Command View EVA, is used to perform all storage system administration tasks, which include:

- Creating virtual disk families, including selection of Vraid level, cache policy, and host presentation
- Managing the presentation of virtual disks to hosts
- Managing storage system hardware
- Creating snapclones and snapshots of virtual disks

Business Copy EVA



HP StorageWorks Business Copy EVA is a local replication software product for the EVA3000 and EVA5000 arrays, providing snapshot and clone setup and management. Business Copy EVA creates point-in-time copies of storage volumes, called Business Continuance Volumes (BCVs) using the snapshot and cloning capabilities of the array firmware and provides a centralized and easy-to-use management interface for local replication operations.

- Business Copy eliminates the need for a backup window by running backup from a snapshot or clone, independent of application processing.
- Licensing is based on usable or snapped capacity rather than total installed capacity.
- Faster performance during local replication to reduce the impact on application processing is a frequent customer request. Business Copy EVA has made a number of changes that help meet this critical customer need.

When to use clones and snapshots

Clones and snapshots can be used in similar ways. Both can be used for offline backup. In offline backup, a dedicated backup server backs up data using the clone or snapshot. This allows the application to continue to run without interruption.

- 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. One such case is when snapshots are made on an hourly basis to ensure a quick restore of files that are accidentally deleted or destroyed. Snapshot is required if the volume to be copied is parity RAID (RAID 3/5).

Key features

Business Copy is controllable:

- **Manageable** — enables more efficient storage administration through an easy-to-use GUI to simplify and automate many manual tasks such as scripting
- **Affordable** — licensing is now based on capacity used, not raw array capacity
- **Centrally accessible** — the GUI runs on a centrally located appliance

Business Copy is resilient:

- **Reliable** — creates up to seven local copies of data to increase productivity and overall business continuity

Business Copy is extensible:

- **Open** — supports multiple operating systems, including HP-UX, Windows NT, Windows 2000, Windows Server 2003, Solaris, and AIX
- **Flexible** — supports mixed disk array environments including the EVA3000/5000 and MA/EMA
- **Scalable** — scales from EVA3000 on up to the EVA5000 to consistently meet storage management needs

The following table describes Business Copy functionality.

Functionality	Business Copy V2.1A	Business Copy V2.2
VCS support	VCS 2, 2.003, 2.005, 3	VCS v2.006, 3.0, 3.010
Enhanced mode host agents	<ul style="list-style-type: none"> ■ Windows ■ HP-UX 11/11.11 ■ AIX 4.3, 5.1, ■ Solaris 2.6/8 	<ul style="list-style-type: none"> ■ OpenVMS ■ HP-UX 11.23 ■ Tru64 UNIX 5.1b ■ Windows 2000 V5 ■ Windows Server 2003 (32/64 bit) ■ AIX 5.2
Licensing rules	Based on the total number of copy images created from all source volumes.	Based on total source volume capacity replicated regardless of number and type of copy images created.
License SKUs	2TB minimum, 2TB upgrades	1TB minimum, 1TB upgrades

Business Copy business value and target customers

Business Copy provides value in increased business continuity, data availability, and productivity savings.

- Potential for revenue opportunities and operational efficiencies due to improved business continuity
- Improved service levels due to better uptime and data availability
- Increased availability of production data to keep the business running while tasks such as data mining or migration, backups, upgrades, testing, and work distribution take place
- Lower cost of ownership due to capacity-based licensing, and lower administration costs resulting from reduced IT time and effort

This product is indispensable for critical data center operations such as non-disruptive backups, frequent snapshots of high value databases, and data mining.

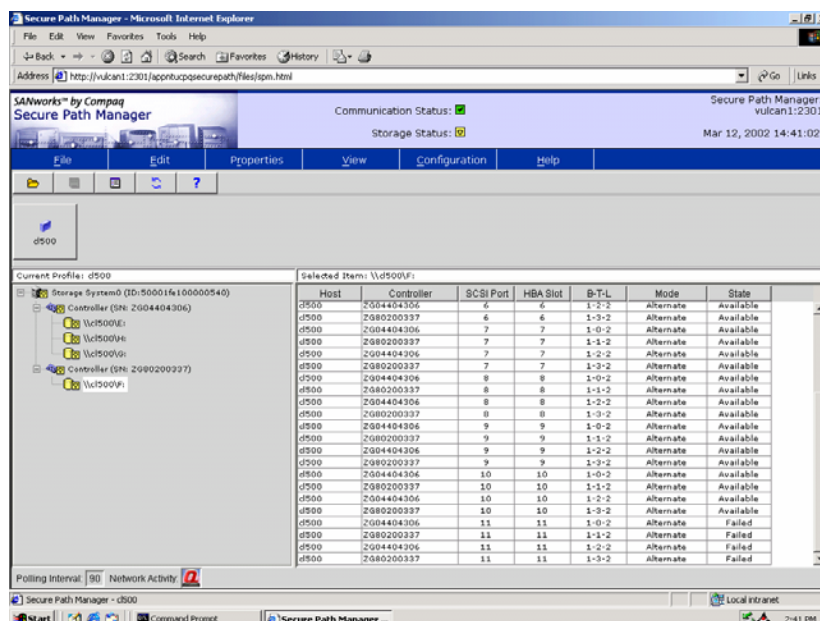
The target market for Business Copy includes large enterprise and mid-range customers with initiatives aimed at improving business continuity and disaster protection, both of which involve local replication applications. These are customers who:

- Need to shrink their backup windows
- Need to perform simultaneous multiple applications on several copies of the same data volumes
- Need multiple copies of the same data volumes to process simultaneously
- Have non-disruptive backup capability already in place or in plan
- Have an overall need to process more applications in the same amount of time
- Are looking for ways to increase productivity of IT resources

Target industries for Business Copy include finance, insurance, manufacturing, services, media and entertainment, healthcare, retail. In short, any industry that cannot afford the cost of downtime needs this replication software.

The target customers are the storage administrators or database administrators within these corporations. These are IT managers and data center managers with planning responsibility for storage; they experience the greatest impact when data is lost or data access windows are impaired due to the inaccessibility of storage.

SecurePath



In today's business environment, customers require computing systems that guarantee availability on a 7x24 basis. HP StorageWorks SecurePath satisfies the customer requirement for solutions that provide no single point of failure in a SAN and external storage solutions.

SecurePath is multipath, high-availability software that manages and maintains continuous data access to HP storage systems. SecurePath is host-resident software that monitors the data paths between server and storage to increase availability of information. In the event that a path failure is detected, SecurePath fails over to an alternative path. When the original path becomes available, SecurePath can automatically failback to the original path.

Key features

- **High availability** — SecurePath provides high availability in complex storage area networks, ensuring application and data availability in enterprise solutions. SecurePath can be used in:
 - Standalone configurations
 - Cluster configurations
 - Disaster-tolerant solutions
- **No single point of failure** — Its multiple path failover capability and redundant component architecture eliminate single points-of-failure from server to storage in a clustered or single server configuration. SecurePath effectively eliminates controllers, disk drives, interconnects (for example, switches), and host bus adapters as single points of failure in the storage subsystem. The software monitors the path between the server and storage, and moves to an alternate path if failure is detected.

- **Performance** — SecurePath products provide automatic load distribution for Windows, Sun, and HP-UX hosts across the available paths to optimize the performance of the storage controllers. Administrator-controlled load-balancing capability is available for IBM-AIX and NetWare hosts.
- **Storage Support** — SecurePath supports a range of HP storage arrays:
 - EVA
 - MSA1000
 - MA/EMA

Benefits

Feature	Function	Benefit
Multiple path management; up to 32 paths/LUN depending on host	Reroutes I/O to functioning alternate path in case of hardware failure	No single point of failure from server to storage
Dynamic load balancing	Monitors and reroutes data to balance I/O load using the models as follows: <ul style="list-style-type: none"> ■ Round robin (goes from one path to another in some order), least I/O, and least bandwidth on the Windows platform ■ Round robin on the SUN and HP-UX platforms 	Increased performance
Proactive path checking	In the background, determine failed path and take necessary action to ensure availability of path between host and storage	High availability
Remote management with SecurePath manager	Web-based graphical user interface Displays current path status and optimizes path utilization for Windows and NetWare hosts	Ease of use
Automatic fail back	Online automatic return of storage sets to repaired preferred I/O path	Lights-out operation
LUN expansion with Windows 2000 dynamic disk support	Allows most maintenance without loss of services	Improved availability for 7x24 support

SecurePath Versions

- SecurePath for Windows and Windows Workgroup Edition
- SecurePath for Linux and Linux Workgroup Edition
- SecurePath for HP-UX and HP-UX Workgroup Edition
- SecurePath for Sun
- SecurePath for IBM AIX
- Added boot support for EVA, XP and VA
- Added support for HP-UX 11.0 for XP and VA
- Added support for HP-UX 11.23 on HSG80 arrays

SecurePath business value and target customers

SecurePath provides business value in three primary areas:

- Protects paths between heterogeneous hosts and storage systems to ensure high data availability
- Simplifies the management of paths in complex SANs, thereby lowering administration costs
- Protects customers against unplanned downtime by eliminating single points of failure

The target market for SecurePath includes:

- Customers who require the highest level of availability for applications
- Large IT environments with heterogeneous hosts all sharing the same storage
- Customers who have experienced significant costs as a result of downtime caused by a failure in their data path

Target industries include financial services, pharmaceutical and xSP (for example ASP, SSP) /e-commerce.

The target customers for SecurePath are IT managers, who also buy or recommend storage hardware. Any customer whose business depends on uninterrupted connectivity between application and data is a good candidate for SecurePath. Any new sale of a RAID solution should include SecurePath, especially any new sale of the MSA1000 in a redundant controller configuration.

Storage Volume Growth

HP OpenView Storage Volume Growth is host-based software that provides IT administrators with the ability to dynamically grow the Windows 2000/Windows Server 2003 file system, enabling it to recognize new capacity created through array-based volume expansion on the StorageWorks Enterprise Virtual Array. The product is based on the capability included in Storage Virtual Replicator, a stable and mature HP storage technology. Storage Volume Growth gives HP a competitive advantage by extending the capacity-expansion capabilities of the EVA to provide a complete, HP-supported end-to-end solution in Windows 2000 or Windows Server 2003 operating system environments.

Key features and benefits

- Dynamic expansion of NTFS basic disk volumes on host systems running the Windows 2000 or Windows Server 2003 operating system. Enables the Windows file system to recognize the capacity expansion performed at the array level without disrupting applications or user access to data.
- A Microsoft Management Console (MMC) snap-in graphical user interface with a set of wizards. Simplifies the usability and operation of the product by enabling users to target specific volumes for expansion and then guide them through the process step by step to completion
- The ability to expand the NTFS basic disk volume by percentage or by specific megabyte. Allows users to control the expansion of volumes based on parameters that make the most sense to them or their business.
- Iterative growth capability provides flexibility because the volume expansion is not a one-time event, but can be done multiple times provided sufficient space is available in which to expand the volume.
- One-year 8x5 telephone support as well as rights to new versions, media, and documentation distribution service is included with the product purchase.

Target customers

Target customers are those deploying EVA storage systems in Windows 2000 environments.

- EVA operating system mix is 60% Windows.
- Server-to-EVA ratio assumption is 5 to 1.

These customers may need to expand their file systems to accommodate increasing storage requirements. Some customers may assume that dynamic storage growth is available using the EVA controller-based dynamic volume growth feature, but it is not operable if the file system on which user data resides cannot be expanded. HP OpenView Storage Volume Growth software is required.

Continuous Access EVA

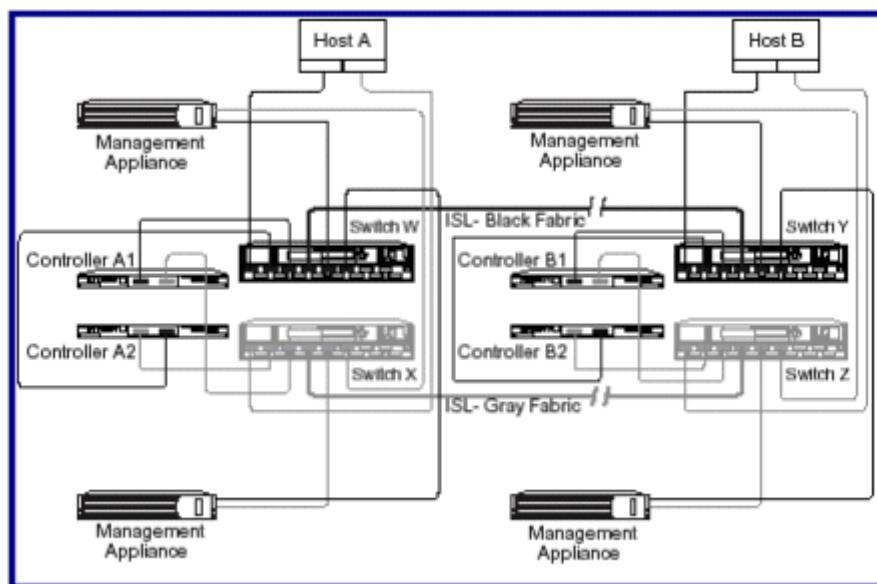
Continuous Access EVA is a solution for mirroring data online and in real time to remote locations on a local or an extended storage area network. Using controller and management software, data replication is performed at the storage system level and in the background to any host activity.

Continuous Access EVA provides disaster tolerance through the use of hardware redundancy and data replication between two EVA storage systems that are separated by a safe distance. Multiple hosts can be connected to one or more shared storage systems that run homogeneous or heterogeneous operating systems.

What does CA do?

The figure below shows a basic Continuous Access EVA configuration consisting of two separated storage systems. One is located at a primary (or local) site and the other is at an alternate (or remote) site. In this illustration, two redundant fabrics are shown. One fabric is called the **gray fabric** and the other fabric is called the **black fabric**.

Each storage system can perform primary data processing functions as a source, with data replication occurring on the destination storage system. Data can also be **bi-directional**, with some data groups moving to the storage system and other groups moving simultaneously from the storage system. This feature can make the storage system the source for some data groups and the destination for others.



Failover

If a significant failure occurs at the source storage system location, hardware and software redundancy allows data processing to quickly resume at the destination storage system, where the data is intact. This process is called failover. When the cause of the storage system failure has been resolved, data processing can be moved back to the original source storage system by issuing another failover.

The basic Continuous Access EVA configuration requires at least two HP OpenView Storage Management Appliances (SMAs), with a minimum of one at each site. One or more SMAs can be active at the same time, but only one SMA can manage a particular EVA over a specific point in time. The SMAs run the graphical user interface applications used to manage the storage tasks.

Business continuity terminology

- **Disaster tolerance (DT)** — The ability to suffer a major outage and maintain continuous access to vital data and applications.
- **Synchronous** — A type of mirroring that writes completely to a remote array before the application continues. Latencies are approximately 1 ms per 100 km. RPO is current.
- **Asynchronous** — A type of mirroring in which the application continues without waiting for a response. It adds no additional latency. RPO is not completely current; some transactions can be behind.

CA features

CA uses some of the leading-edge technologies of HP to enhance the disaster-tolerant solution to perform

- Point-in-time local replication
- High-availability FC multipath support
- Dual FC fabric, nearline data protector
- Campus, metro, or continental SAN extensions

CA features include:

- Full feature remote replication interoperability between EVA5000 and EVA3000
- Both asynchronous and synchronous replication
- 128 copy sets and 128 disaster recovery groups
- SAN array-based remote data replication solution
- Synchronous mode replication to provide the best data protection (up to the last I/O in real-time); asynchronous mode provides better performance but offers less data protection

- True bi-directional replication
- Centralized OpenView Storage Management Appliance user interface through a web-based browser
- Heterogeneous host operating system support (HP-UX, Sun Solaris, IBM AIX 5.2, Linux, Microsoft Windows 2003 64-bit, OpenVMS, Tru64 UNIX)
- Disaster-tolerant throughout with no single point of failure
- Automated failover management at various levels (Vdisk, copyset, DR group, storage cell, or full site)
- SAN extension support for campus, metro, and continental configurations

Target customers

CA benefits customers who determine that the cost of extended downtime and the risk of potential data loss outweigh the cost of duplicate systems and the supporting infrastructure. These companies:

- Need to recover from a disaster within seconds or minutes, as opposed to days or weeks -- for example, financial (brokerage/trading, credit card suppliers), media, retail (on-line and TV sales), and airline reservations
- Need to implement business continuance planning (BCP) to move management, employees, and data from one location to another
- Require data migration from one storage subsystem to another for application testing or moving to a dual-site operation

CA enhancements over Data Replication Manager

Continuous Access for EVA software provides significant enhancements over Data Replication Manager software, for example:

- More LUNs, smaller LUNs
- True bi-directional
- Connection failover
- Synchronous performance
- Normalization/initialization performance
- Write history log performance
- Shorter failover/recovery times
- Dynamically expandable LUNs
- Simplified command structure
- Space-efficient Vsnapshots

EVA management components summary

In this section, we discussed EVA management, starting with hardware — the management appliance. Then, we looked at the EVA software management components and the business value of each:

- Virtualization controller software
- Storage Operations Manager
- Command View EVA
- Business Copy EVA
- SecurePath
- Storage Volume Growth
- Continuous Access (CA)

EVA qualifying questions

This module has examined the EVA target market, the business value proposition, and the key features and capabilities of the EVA that match the business value. How do we qualify EVA target customers? First, let's review the business challenges the EVA target market faces:

- **Business continuity** — Protecting business operations from major interruptions is one of the most critical issues facing many customers. Continuity of business processes is very important for customers who have business-critical databases and applications, and 365x24 business operations. These customers need highly accessible data.
- **Consolidation** — EVA target customers need to efficiently configure, manage, and maintain storage resources. They need efficient storage utilization (online and nearline).
- **Heterogeneous support** — Customers need centralized data and flexible storage capacity and efficiency for data across a variety of operating systems.
- **Database growth and recovery** — Customers need to offload the network traffic associated with storage access onto the separate network to effect lower latency, more efficient resource utilization, and significantly faster data speeds. EVA target customers need improved uptime and access to data as well as faster application deployment.
- **Need for operational efficiencies** — Protecting storage investments and reducing IT staffing costs are primary concerns of most customers. EVA target customers need more efficient storage management, automation, and simplification of management tasks.

Given these challenges, the following questions will help to begin the qualifying process:

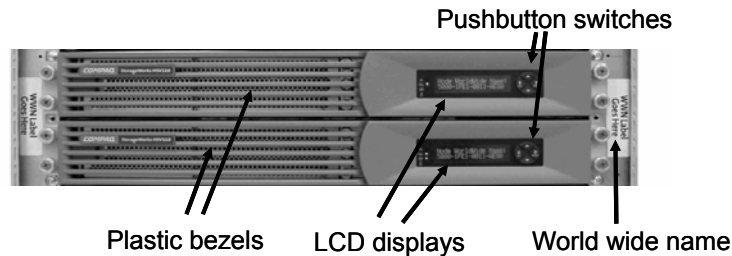
- Does your business success increasingly depend on data and access to data?
- Are you looking for more efficient storage utilization and space savings?
- Do you have a heterogeneous operating system environment?
- Are you experiencing rapid database growth and smaller backup/restore windows?
- Do you need reliable access to data?
- Do you need faster application deployment?
- Do you need to reduce downtime during storage expansion?
- Do you need to do more with fewer IT staff and resources?
- Do you need to improve existing service levels?

EVA system components

Next, we will examine the significant system components:

- HSV-series controllers
- FC disk drive advantages
- FC loop switches
- Heterogeneous operating system support

HSV series controllers



Overview

The HSV-series (V for “virtual”) controllers are completely new and not revisions of the HSG80 controllers. Each Enterprise Virtual Array requires at least one HSV controller pair. The pair of controllers combined is only 3U high, 1U shorter than the enclosure for a pair of HSG80 controllers.

Connectivity ports

The HSV-series controllers have

- **Two** 2GB/s “ready” FC switch fabric host ports per controller, compared to two 1Gb/s FC host ports on an HSG80 controller.
- Device ports
 - The HSV110 controller contains **four** 2Gb/s FC-AL device ports per controller, compared to six Ultra SCSI device ports on an HSG80. These device ports are arranged in redundant pairs that are load balanced for best performance. (If one loop is more highly utilized, the controller will use the lower utilized one as well.)
 - The, the HSV100 controller contains **two** 1Gb/s FC-AL device ports.

Feature	HSV110 (EVA5000)	HSV100 (EVA3000)
Drive support	Up to 240 disk drives per controller pair (up to 12 drive enclosures per cabinet)	Up to 56 disk drives per controller pair (up to four drive enclosures per cabinet)
Internal FC-AL device ports	Four 2GB/s FC-AL device ports—arranged in redundant pairs	Two 2GB/s FC-AL device ports—arranged as a single redundant pair
VCS software	<ul style="list-style-type: none"> ■ VCS 2.0a for HSV110 ■ VCS 3.0 for HSV110 	VCS 2.0 for VCS100
Business Copy support	BC EVA5000 v2.1a	BC EVA3000 v2.1a
Continuous Access support	Continuous Access EVA	Not yet available

FC disk drive advantages

Because of the number of signals/pins required for the interface, SCSI drives only have one port, with no redundancy or load balancing option of a second port. Fibre Channel drives have two ports that provide redundancy and load balancing.

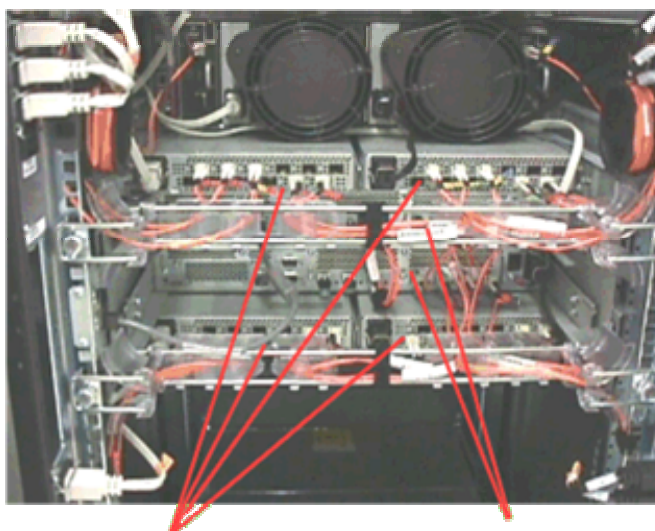
The SCSI interface has a limited distance that it can support and, as a result, a limited number of disks per bus. The HP FC interface allows up to 120 drives on redundant pairs of FC buses. The redundant pair of buses also allows load balancing, so that if one bus or port is busy, any drive can be accessed on the other bus or port.

In some cases, SCSI and drives share the same mechanics, but they are beginning to diverge. Some SCSI drive vendors are designing new drives with lower cost in mind, trading off performance for cost, because the drives have a wide range of applications, including PCs and low-end servers. FC drives, on the other hand, are being designed for high-performance and high-capacity storage applications.

FC loop switches

Fibre Channel loop switches are positioned above and below the HSV110 controllers. With up to 11 FC cables (with an expansion cabinet connected) per loop switch, a cable management system is necessary to keep the FC cables neat and to avoid sharp bends that can damage cables.

Loop switches improve the ability to diagnose FC disk errors, improve serviceability by making it easier to replace a FC shelf, and improve the ability to expand by adding additional drive shelves or adding an expansion cabinet.



Fibre Channel Loop Switches HSV110 Controllers and Enclosures

Heterogeneous operating system support

Support for industry-leading operating system platforms includes:

- Windows NT 4.0 SP6a
- Windows 2000 5.0 SP2, SP3
- Windows Server 2003 Enterprise Edition
- Windows Data Center Advanced Server v5.0 SP2
- HP Tru64 UNIX 5.1 Patch Kit 3, 5.1a IPK, 5.1b
- SUN Solaris v2.6, v7, v8, v9
- HP OpenVMS v7,2-2 F-S V0200, 7.3
- HP-UX v11.0, 11.1
- IBM AIX v4.3.3, v5.1, v5.2
- Linux* Red Hat® 7.2 and Advanced Server 2.1 for X86, SLES 7 for x86
- NetWare* 5.1 and 6.0

EVA system components summary

We have taken a look at:

- HSV-series controllers
- FC disk drive advantages
- FC loop switches
- Heterogeneous operating system support

Next, we will discuss the EVA3000 and the EVA5000 in more detail.

* Single path support only.

EVA5000 product information

The EVA5000 is designed for the data center where there is a critical need for improved storage utilization and scalability while meeting

- Application-specific demands for consistently high transaction I/O and megabyte data rate performance
- Seamless capacity expansion
- Instantaneous replication
- Simplified storage administration

The EVA5000 is an ultra-high performance, ultra-high-capacity and ultra-high-availability “virtual” RAID (Vraid) storage solution for the upper end of the enterprise marketplace that removes the time, space, and cost boundaries of traditional storage.

- Leading-edge HP StorageWorks Continuous Access EVA v1.1 provides outstanding self-tuning performance and ensures consistency in meeting application service level agreements. It allows users/clients to accomplish more in less time, scale capacity on demand, and minimize data administration overhead.
- The EVA5000 is a Fibre Channel solution that uses FC-switch fabric for interfacing with the host and 2Gb dual-loop FC-arbitrated loop to interface to the disk drives.
- The EVA5000 is compatible with most of the earlier 1GB FC HBAs and SAN switches and the newer 2GB FC HBAs and SAN switches.
- State-of-the-art controller software, with virtualization technology, helps improve performance, increases disk utilization efficiency, and allows for easy dynamic storage expansion, all of which helps lower costs.
- EVA solutions are built with new storage assembly enclosure packaging. The packaging consists of
 - 3U FC Vraid dual controller assembly
 - HP StorageWorks Enclosure Model 3220
 - 3U 14-bay FC drive enclosures

The controller and drive enclosures are independent of each other to allow a wide range of configuration options. The EVA predefined models are designed to address medium- to high-capacity needs as well as high-performance options in commercial environments. The models are available in 42U graphite cabinets.

- HP StorageWorks Business Copy EVA comes complete with an improved user interface and support for the Vsnap function, which can save customers significant disk space and improve disk utilization efficiency.
- HP StorageWorks Business Copy EVA includes Virtually Instantaneous Snapclone copy capability, which allows immediate use of the clone copy, which provides customers with significant time savings.
- HP is introducing a new service solution portfolio for the EVA5000 models. The suite of offerings includes Foundation Service Solutions, Proactive Service Solutions and Enhanced Proactive Service levels.

General-purpose EVA5000 products

The general-purpose EVA5000 product is available in a choice of two predefined configurations with controllers or two expansion configurations without controllers. It is enclosed in a 42U graphite cabinet that is optimized for commercial environments. The solutions include support for the most popular multivendor operating system platforms and stringent data center availability enhancements such as multi-pathing and clustering.

Customers can configure and manage up to 16 EVAs with HP OpenView Storage Operations Manager and Command View EVA v3.1, which resides on the HP OpenView Storage Management Appliance. The Storage Management Appliance is required. The EVA cannot be managed without the Storage Management Appliance running Command View EVA v3.1.

Technical computing EVA5000 products

The technical computing EVA5000 product is specifically designed to deliver maximum, high-bandwidth, performance for low latency read/write operations typically demanded by high-performance technical computing and other compute-intensive application environments. The predefined 8C8D configuration is available in a 42U graphite cabinet that is optimized for high-performance, technical computing environments.

EVA3000 product information

With the EVA3000, high-end enterprise power moves into the mid-range. The EVA3000 is a high-performance, high-availability Vraid storage solution serving the intermediate storage needs of the enterprise and the mid-range storage market.

The EVA3000 complements the current EVA5000 solutions. It is designed for data centers where there is a critical need for improved storage utilization and scalability while meeting

- Application-specific demands for consistently high transaction I/O and megabyte data rate performance
- Seamless capacity expansion
- Instantaneous replication
- Simplified storage administration
- Cost effectiveness

With the latest EVA3000 software, HP StorageWorks Virtual Controller Software v3.0 for HSV100, the EVA3000 Virtual Array Controller functionality has been enhanced with leading-edge storage replication capability, HP StorageWorks Continuous Access EVA (CA EVA). The EVA3000 continues to provide state-of-the-art virtualized snapshot capability with the HP StorageWorks Business Copy EVA.

What's new?

- Remote replication capability with HP StorageWorks Continuous Access EVA v1.1
- Supports three storage racking options and three HP-UX server racks (Rack System/E racks)
- New EVA service portfolio that provides simple combinations of hardware and services (Foundation Service), offers 3-year, 24x7, 4-hour hardware response time, and VCS call-in support
- Supports HP OpenView Storage Operations Manager software v1.0 for EVA

Key features

- Vraid enables data to be distributed from 8 to 56 disks to increase disk spindle count far beyond traditional RAID sets. This virtualization method optimizes storage for the best performance of a specific configuration and application.
- State-of-the-art controller software improves performance, increases capacity, and allows for easy dynamic storage expansion.
- High-density packaging and support of more disks per controller pair allows up to 8TB, using 56 disks per controller pair.
- Easy-to-order completely integrated configurations with a single part number include disk drives, VCS, and system platform software kits.
- Easy-to-use storage management tools allow customers to manage larger SAN configurations with more servers and more storage solutions.

The following features are provided by the optional Business Copy EVA software:

- Vsnap replicates data instantly by taking a picture of the data within seconds without reserving an equal amount of capacity. This process saves significant disk space and improves disk efficiency.
- Virtually Instantaneous Snapclone makes a complete copy of data, which is accessible before the copy completes. The copied data can be used as a test platform for application changes and additional performance benchmarking, as well as for mounting tape backups.

The following capabilities are provided by the optional Continuous Access EVA software:

- Disaster-tolerant replication across a Fibre Channel SAN
- Real-time replication between Enterprise Virtual Array 3000 storage systems
- The highest level of FC SAN data protection to meet disaster-tolerant business continuity implementation goals

EVA3000 product packaging

The EVA3000 solutions are built with new storage assembly enclosure packaging. The packaging consists of a 3U FC dual controller assembly and two 14-bay M5314 FC drive enclosures. The controller and drive enclosures are independent of each other to allow a wide range of configuration options.

The EVA3000 predefined models are designed to address moderate capacity needs ranging (from 1–8TB) as well as high-performance options in commercial environments. The models are factory rack-mounted in either of the following:

- EVA cabinet (based on the HP rack 10000 series, with a choice of 42U, 36U, and 22U heights)
- Rack System/E cabinets (choice of 41U, 33U, and 25U heights) via the factory integration process.

EVA3000 and CX400 comparison

	EVA3000	EMC/Dell CX400
Architecture	Virtual	Traditional
IOPs (15k HDDs)	162,000	60,000
Seq. read throughput	337MB/s (from disks)	680MB/s (from cache)
Maximum capacity	56 FC HDDs/8.2TB	60 FC HDDs/8.8TB
Maximum cache	1GB/controller	1GB/controller
Host ports	4 x 2Gb/s FC	4 x 2Gb/s FC
Back end ports	2 x 2Gb/s FC	4 x 2Gb/s FC
Host support	HP-UX, Linux, Windows, Tru64 UNIX, OpenVMS, NetWare, Solaris, AIX	Linux, Windows, NetWare, Solaris, HP-UX, AIX, SGI IRIX, Tru64 UNIX
Software	Command View, SecurePath, Business Copy, Continuous Access	Control Center, Navisphere, Access Logix, PowerPath, SnapView, MirrowView

EVA3000 and EVA5000 shared features

The EVA3000 and EVA5000 allow IT professionals to leverage training and expertise across their entire data center:

- Same powerful feature/function set
- Similar operating system support
- Same software support
- Same storage management
- Same server connect support
- Same SAN interconnect, switch, and HBA support
- All the virtualization value opportunities

Positioning

Sell EVA3000 when customer requires:	Sell EVA5000 when customer requires:
<ul style="list-style-type: none"> ■ Sweet spot <28 disks (<4TB) ■ Moderate growth (up to 8TB over 2–3 years) ■ 8TB maximum capacity ■ Low-cost mid-range storage array ■ Minimum configuration — 0.5TB (8 disks) ■ Reduced total cost of ownership ■ Very easy management ■ Much higher capacity utilization ■ Excellent performance ■ Replication CA and CASA 	<ul style="list-style-type: none"> ■ Sweet spot >28 disks (>4TB) ■ High growth (up to 20TB over 2–3 years) ■ 70TB maximum capacity ■ Moderate starting cost ■ Minimum configuration — 0.25TB (8 disks) ■ Minimal expansion disruption <ul style="list-style-type: none"> ■ Add back-end loop switches after the fourth disk enclosure ■ Reduced total cost of ownership <ul style="list-style-type: none"> ■ Very easy management ■ Much higher capacity utilization ■ Excellent performance ■ Replication CA and CASA

Supported operating systems

Operating systems	EVA3000	Eva5000
HP-UX	✓	✓
Tru64 UNIX	✓	✓
Windows NT/Windows 2000	✓	✓
Solaris	V6, v7, and v8 initially	✓
AIX	✓	✓
OpenVMS	✓	✓
Linux (Intel)	Single path initially	With SecurePath and clustering
NetWare	Single path initially	With SecurePath and clustering
Windows 2003 (.NET)	✓	✓

Feature comparison

	EVA3000	EVA5000
Number of controllers	Two HSV100	Two HSV110
Maximum capacity (raw)		
36GB HDD	2.1TB	8.6TB
73GB HDD	4.1TB	17.5TB
146GB HDD	8.2TB	35.0TB (two cabinets)
Peak IOPs from cache	162K	168K
Peak IOPs from disk (15K rpm)	13k	55K
Disk sizes/speeds (rpm)	146GB/10K 73GB/10K, 15K 36GB/15K, 10K	146GB/10K 73GB/10K, 15K 36GB/15K, 10K
Maximum number of drives	56	240
Maximum number of disk shelves	4	18*
Peak sustained throughput	337MB/s reads 127MB/s mirrored writes	560MB/s reads 175MB/s mirrored writes
Cache capacity	2GB	2GB
Host ports	4	4
Host port types	2Gb/s FC	2Gb/s FC
RAID configuration supported	Vraid0, Vraid1, Vraid5	Vraid0, Vraid1, Vraid5

*No drive enclosure redundancy for configurations with <6 enclosures

Services solution portfolio

The EVA service portfolio provides simple combinations of hardware and services needed to rapidly deploy the EVA product and maintain a solid EVA storage platform.

EVA Foundation Services Solution

EVA Foundation Services Solution quickly deploys a highly available Enterprise Virtual Array storage platform into production and delivers ongoing hardware and VCS support.

- **EVA3000 Foundation Service Solution** — 3-year, 4-hour response, 24x7 support; 3 years of 24x7 VCS phone-in support and upgrade service; installation and startup service including virtual disk design.
- **EVA5000 Foundation Service Solution** — 3-year, 4-hour response, 24x7 support; 3 years of 24x7 VCS phone-in support and upgrade service; installation and startup service including virtual disk design.

EVA Proactive Services Solution

EVA Proactive Service Solution helps bring your customer's array online and delivers the proactive and reactive support required to maintain a stable storage platform over time. The additional features provided in this service level, such as change management and ongoing advice and assistance, enhance the return on your customer's storage investment.

The EVA5000 Proactive Service Solution provides

- Automated event notification
- 3 years of assigned account team
- Documented account support plan
- 3 years of monthly activity reporting
- 3 years of semiannual support planning meetings
- 3 years of 2 days per year ongoing account and change management
- 3 years of 1 day per year storage/SAN firmware recommendations
- 3 years of annual high availability (HA) technical evaluation

EVA Enhanced Proactive Service Solution

EVA Enhanced Proactive Service Solution takes the features of the Proactive Service Solution even further by offering SAN Solution Service at deployment.

- EVA5000 Proactive Service Solution plus Level 1 SAN Solution services (configuration up to 64 ports including two operating systems).

Pay per use for StorageWorks EVA

HP Pay Per Use for StorageWorks EVA is a “pay as you go” storage solution that allows customers to select the storage configuration and software that are appropriate for them and then be charged monthly for the amount of storage used.

A technology-driven financial instrument, PPU EVA is ideal for enterprises that want closer alignment of storage costs to business conditions, as well as for those facing uncertain capacity demands. With PPU EVA, customers can

- Balance the risks and costs associated with investments in storage
- Avoid locking capital into storage infrastructure
- Allow for growth and change by providing flexible capacity, software, and technology upgrades

PPU EVA is designed for businesses with uncertain storage capacity requirements. Customers do not own anything—they share the investment risk with HP. HP metering technology tracks usage and enables customers to pay based on usage. PPU EVA makes sense when a company cannot afford to fall short on capacity and miss important business opportunities.

Customer challenges

- Flexibility to meet growth and surges in demand
- Application availability
- Storage scalability
- Rapid application deployment
- Ability to control and monitor storage utilization
- Simple, predictable business management
- High upfront IT investment

Why sell pay per use?

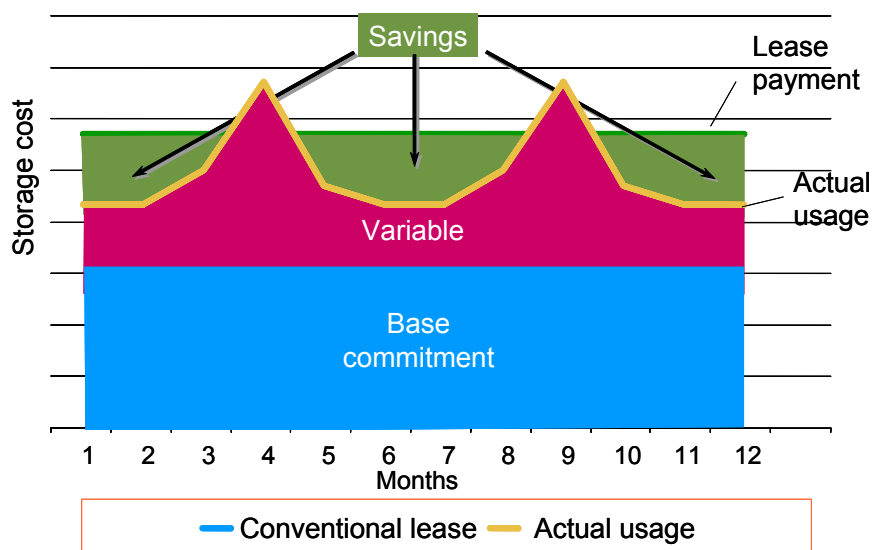
- Opens new doors
- Provides upsell opportunities for OpenView SAM and managed services
- Close larger deals
- Market and competitive pressures
- Opportunity exists with installed base of HP 9000 customers

Target customers

- Customer has peaks and troughs in utilization:
 - Seasonal variation (for example, retail, financial)
 - Monthly peaks (for example, financial, payroll)
 - Daily peaks in Monday–Friday, 8 a.m.–6 p.m. operations
- Customer has demand or sizing uncertainty.
- Customer's impact of **not** meeting SLAs is high.
- Customer wants to closely match costs with revenue or charge back usage to customers.

Pay for capacity only when you use it

Pay per Use is designed for highly volatile environments in which a utility meter tracks usage and enables customers to pay rent for actual usage. A highly flexible approach designed for dynamic demand, a customer pays a monthly base payment with usage daily peaks averaged into a monthly variable payment.



Note

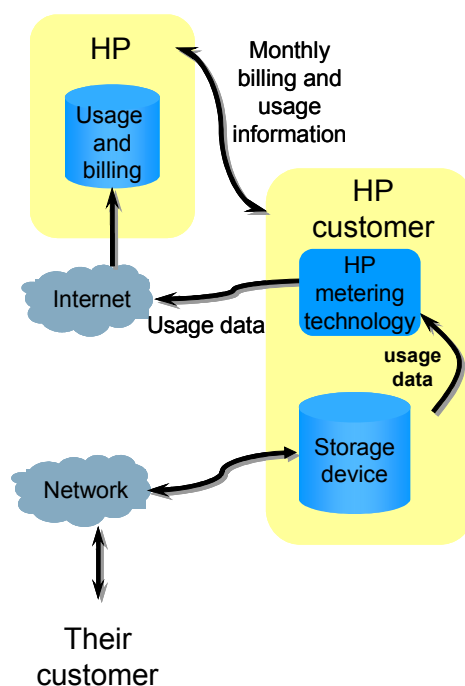
PPU for EVA is an internal sales program that is available in North America and EMEA. Currently, it is **not** sold by partners. It is currently classified as a “solution” and not as a “service.”

Traditional acquisition versus pay per use

	Traditional IT acquisition	Pay per use
Cost	Fixed assets	Computing resources delivered at a price base on usage
Risk	<ul style="list-style-type: none"> Financial risk – IT cost structures are monolithic & fixed Hardware & IT capacity not adjusted in real time 	<ul style="list-style-type: none"> Reduced risk because someone else owns the assets Sharing business risk because underutilization means savings for the customer through lower payments
Agility	Cannot quickly adjust capacity or IT infrastructure cost structures or resources as business needs change	IT can respond instantly to business change

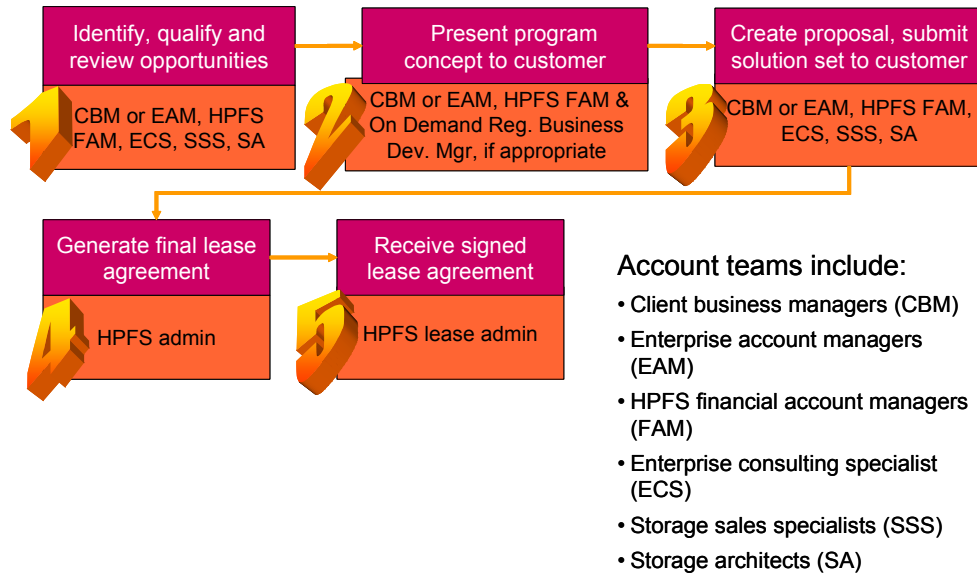
How PPU works

- Storage devices and metering technology physically reside at the customer's site
- Metering technology regularly measures the amount of configured capacity (capacity assigned to a port) and sends it to HP
- Usage data is averaged and customer receives a monthly bill
- The customer can monitor and validate usage data
- HP owns storage assets
- Support contract is included



5-step sales engagement process

As you can see, this is truly a cross-functional sell.



Therefore, it is imperative that HP and partners serve the unique and varied requirements of our customers and our sales team members administering this highly consultative sales process. The actual selling stages are similar to other HP solutions:

1. Evaluate and understand the customer's business and IT environment.
2. Develop plans linked to the customer's business strategy and initiatives.
3. Establish buying vision with the customer by co-developing solutions that meet customer needs and reinforce HP as the "trusted advisor."
4. Resolve any concerns regarding solutions approach and secure final commitment for solutions implementation.
5. Monitor implementation and ensure that customer expectations are met or exceeded for ultimate success!

Qualifying the customer

- Do you anticipate significant changes in storage requirements over the next 12 months?
- How do you measure allocated storage today?
 - Are you getting the required information on storage use to effectively support your business?
 - Do you have variable needs for storage?
 - Are you currently using HP PPU for UNIX servers?
 - Do you have capital spending constraints?
 - How are you planning to acquire your storage? Cash purchase, lease, etc.?

Customer benefits of pay per use

- Simplifies capacity planning
- Pay for storage based on capacity usage
- Financial advantages of leasing
- Reduces up-front IT investment
- Less frequent procurements
- Enhances alignment of costs with service levels
- Improves cash flow through better alignment of cost-to-revenue
- Reduces business risk
- Increases capacity to meet service-level agreements
- Increases ability to adapt to an ever-changing environment

When to sell Enterprise Virtual Array 5000 vs. XP

HP will continue to offer both XP and EVA arrays for the foreseeable future. The EVA5000 and the XP offer customers a choice between rack-based and frame-based disk arrays. Each has its own distinctive features that meet specific customer needs. Together the two solutions comprise a high-end disk array portfolio that leads the industry in business value, performance, scalability, and flexibility.



EVA (rack-based)



XP (frame-based)

Sell EVA5000 when customer needs:

- High scalability in a network storage design (modular architecture)
 - High capacity utilization and efficient management
 - Point-in-time copies with minimum capacity needs
 - Auto load balancing and self-tuning performance
 - Lowest TCO
 - Disaster recovery (Continuous Access EVA)
 - HP-UX, NT/Windows, Linux, NetWare, OpenVMS, Tru64 UNIX, Solaris
-

Sell XP when customer needs:

- High scalability in a single platform (frame architecture)
 - Broad and robust HP-UX solutions
 - Mainframe connectivity
 - Broad disaster recovery solutions
 - HP-UX, OS/390, MPE/iX, Bull AIX, Fujitsu/Siemens UX, Linux, NetWare, SGI
 - Solaris, AIX together
-

Configuring/ordering steps

EVA3000

The EVA3000 is available in one of four integrated “independent bundle” configurations. Each bundle includes:

- One pair of HSV100 controllers
- Two FC drive enclosures
- 8 to 16 integrated FC hard drives, which vary by bundle

EVA3000 independent bundles are factory integrated in a choice of:

- EVA cabinet (22U, 36U, 42U)
- Rack System/E rack systems (25U, 33U, 41U)

A Configure-to-Order (CTO) program is available. Configured solutions provide support for the most popular multivendor operating system platforms and stringent data center availability enhancements such as multi-pathing and clustering.

Start the order by choosing a rack to house the EVA3000. If your customer does not want optional components such as additional drive enclosures, switches, or drives assembled at the factory, simply list the selections on the sales order without the CTO program.

Next, select one of the pre- base models and add additional storage or any of the other supported HP component.

Enterprise Virtual Array 3000 independent bundles include the Foundation Service Solution as well as the following.

- **EVA3000 2C2D-C/16x36GB/15K**

Ships with one 3U controller assembly with two HSV100 controllers with redundant power supplies, two M5314 3U dual-redundant FC loop 14-bay disk enclosures, appropriate mounting rails, and 16x 36GB 15K rpm HDDs.

- **EVA3000 2C2D-C 8x 72GB/10K**

Ships with one 3U controller assembly with two HSV100 controllers with redundant power supplies, two M5314 3U dual-redundant FC loop 14-bay disk enclosures, appropriate mounting rails, and 8x 72GB 10K rpm HDDs.

- **EVA3000 2C2D-C 8x 72GB/15K**

Ships with one 3U controller assembly with two HSV100 controllers, with redundant power supplies, two M5314 3U dual-redundant FC loop 14-bay disk enclosures, appropriate mounting rails, and 8x 72GB 15K rpm HDDs.

- **EVA3000 2C2D-C/8x146GB/10K**

Ships with one 3U controller assembly with two HSV100 controllers with redundant power supplies, two M5314 3U dual-redundant FC loop 14-bay disk enclosures, appropriate mounting rails, and 8x 146GB 10K rpm HDDs.

EVA5000

The following itemizes the components of the different models in the EVA5000 product set.

Model 2C2D-C

Components include:

- One M3220 3U controller assembly with dual HSV110 controllers
- Two cache batteries
- Two M5214 3U dual-redundant FC Loop 14-bay disk enclosures (FC loop switch is optional)
- Two 0U PDUs
- One 42U graphite storage cabinet
- Available in a 60Hz and 50Hz model
- Includes Foundation Service Solution
- Four disk drives, either of the following size/type are required per disk enclosure per system. Disks are ordered separately:
 - 1.0TB (36GB)
 - 2.0TB (72GB)
 - 4.0TB (146TB)

The Model 2C2D-C can be factory configured up to a five-drive enclosure configuration with an option for FC loop switches. It can be field upgraded to a 2C12D configuration with the addition of drive enclosures and FC loop switches.

Model 2C6D-C general purpose

The 2C6D-C is a general purpose computing model that uses the new graphite cabinet and internal FC loop switches for the FC disk drives. Each model is available in a 60Hz and a 50Hz model and is completely configured including internal interconnect cables. Each complete model requires only one part number.

Fibre Channel disk drives, Fibre Channel cables from the controllers to switches, and software are ordered separately.

Components include:

- One M3220 controller assembly with dual HSV110 controllers
- Two cache batteries
- Six M5214 3U dual-redundant FC loop 14 bay disk enclosures
- Four 12-port FC loop switches (SW-AL)
- Seven 2-port EMU boxes
- Eight AC strips

- Two 0U PDUs
- One 42U graphite storage cabinet
- Available in a 60Hz and 50Hz model
- Includes Foundation Service Solution
- Four disk drives, either size/type are required per disk enclosure per system. Disks ordered separately:
 - 3.1TB (36GB)
 - 6.2TB (72GB)
 - 12.2TB (146TB)

Model 2C12D-C general purpose

The 2C12D-C is a general purpose computing model that uses the new graphite cabinet and internal FC loop switches for the FC disk drives. Each model is available in a 60Hz and a 50Hz model and is completely configured including internal interconnect cables.

Each complete model requires only one part number. Fibre Channel disk drives, Fibre Channel cables from the controllers to switches, and software are ordered separately.

Components include:

- One M3220 controller assembly with dual HSV110 controllers
- Two cache batteries
- Twelve M5214 3U dual-redundant FC loop 14 bay disk enclosures
- Four 12-port FC loop switches (SW-AL)
- Seven 2-port EMU boxes
- Eight AC strips
- Two 0U PDUs
- One 42U graphite storage cabinet
- Available in a 60Hz and 50Hz model
- Includes Foundation Service Solution
- Four disk drives, either size/type are required per disk enclosure per system. Disks are ordered separately:
 - 6.2TB (36GB)
 - 12.3TB (72GB)
 - 24.5TB (146TB)

Configure to Order (CTO) options allow even greater flexibility and scalability. EVA5000 2C6D-C customers can configure their new EVA5000 units from HP Manufacturing with up to four additional drive enclosures for a total of 10-drive enclosures. (The 2C12D-C should be ordered if a customer wants 12-drive enclosures shipped integrated from Manufacturing, and not the 2C6D-C with six additional drive enclosures.)

Existing 2C6D, 2C6D-A, 2C2D-B, 2C6D-B, 2C2D-C, or 2C6D-C customers can also purchase two, four, or six additional drive enclosures (for a total of 8, 10, or 12 enclosures) to be installed on-site by HP Global Services.

Model 8C8D-C technical computing

The predefined 8C8D configuration is optimized for high-performance technical computing environments. It is designed to deliver maximum, high-bandwidth performance for low latency read/write operations demanded by high performance technical computing and other compute-intensive application environments.

The solution includes support for the most popular multivendor operating systems and stringent data center availability enhancements such as multi-pathing and clustering. Configure-to-Order will be available at a future date for the creation of flexible custom solutions using the Enterprise modular storage assemblies.

Many storage systems could not be efficiently configured to meet these requirements. The high performance of enterprise with the new HSV controllers, Fibre Channel disks and disk enclosures, and new modular enclosure packaging provides these performance benefits. Large, monolithic architectures, which rely on large cache to improve their performance, would be very ineffective in applications requiring large block, consecutive I/O, and 100% data writes to disk.

Components include:

- Four M3220 controller assembly with eight HSV110 controllers
- Eight cache batteries
- Eight M5214 3U dual-redundant FC loop 14 bay disk enclosures
- Eight AC strips
- Two 0U PDUs
- One 42U graphite storage cabinet
- Available in a 60Hz and 50Hz model
- This configuration is not the best for general purpose applications where I/Os are small or medium blocks, where the I/Os are much more random, or where the I/Os are mixtures of reads and writes.
- Disks are ordered separately:
 - 4.0TB (36GB)
 - 8.0TB (72GB)
 - 16.0TB (146TB)

Summary

This module has covered the following topics:

- EVA family target customer characteristics and challenges
- Business value of the EVA family
- Linkage between EVA family features and business value
- Management components
- EVA qualifying questions
- EVA family system components
- EVA5000 and EVA3000 comparison
- EVA5000 and EVA3000 shared features
- Services solution portfolio
- Pay Per Use for StorageWorks EVA
- Configuring/ordering steps

Learning check

1. Which set of characteristics best describes the EVA3000 target customer?
 - a. Needs simplified storage management; has storage requirements of less than 1TB; needs to offload storage traffic from the enterprise network
 - b. Looking to save operational costs; experiencing an increasing demand on storage resources; has a low IT budget
 - c. Has moderate storage capacity requirements of greater than 1TB; has large IT budget but is looking for more effective use of storage resources; wants simplified storage management; is concerned about high availability
 - d. Wants to lower total cost of ownership; needs more efficient storage utilization; looking for a low cost solution
2. Vsnapshots contribute to operational cost-savings and efficiencies by
 - a. Enabling the user to easily add disk space as needed
 - b. Not requiring the storage system to reserve capacity for the snapshot volume in advance
 - c. Providing a simplified management interface
 - d. Providing five levels of user data protection
3. Which statement comparing Data Replication Manager (DRM) and Continuous Access (CA) is **true**?
 - a. Both offer asynchronous and synchronous modes
 - b. DRM offers a command line interface while CA offers a central GUI
 - c. DRM offers 256 host connections while CA offers 320 host connections
 - d. Both offer space-efficient Vsnap capability
4. With 146GB disks, two controllers, two 2C12D cabinets, and the optional expansion cabinet, capacity of the EVA5000 expands to a maximum of _____TB.
 - a. 12
 - b. 24
 - c. 70
 - a. 168

5. Continuous Access EVA contributes to which of the following **two** customer business needs?
 - a. Business continuity
 - b. Reduces impact on application processing
 - c. Faster backup
 - d. Disaster recovery
6. The EVA3000 is suitable for customers who expect storage capacity to increase to ___TBs over a 2- to 3-year period.
 - a. 4TB
 - b. 8TB
 - c. 20TB
 - d. 35TB
7. Pay Per Use for StorageWorks EVA is appropriate for customers who (select **three**):
 - a. Want to match costs with charge back usage to their customers
 - b. Have stable IT cost structures
 - c. Have daily, monthly or seasonal variations in utilization
 - d. Prefer to lock capital into storage infrastructure
 - e. Risk high impact of not satisfying service level agreements

HP OpenView Continuous Access Storage Appliance

Module 9

Objectives

After completing this module, students should be able to:

- Identify HP OpenView Continuous Access Storage Appliance (CASA) target customer characteristics
- Describe the business value of the CASA
- Describe the CASA features and benefits

Overview

The CASA delivers robust data replication between homogeneous and heterogeneous devices in the SAN using snapshot, Fibre Channel mirrors and IP-based mirrors. The unique HP software, implementing virtualization technology, is preconfigured on redundant hardware.

CASA target customer characteristics

CASA customers are typically looking to:

- Replicate data on multivendor storage installations specifically running a Windows or HP-UX environment
- Use inexpensive disks to replicate their expensive high-end arrays
- Improve storage efficiency in their large direct attached installations by responding to the need for temporary space and shared disks

CASA value proposition

The CASA allows customers to allocate or replicate storage using a single interface, regardless of the array vendor or host operating system. The CASA helps reduce storage management costs and provides customers with greater choice in future array purchases.

CASA positioning

Sell the CASA when:

- Mid-range configurations need cost-effective data replication
- Running Windows and HP-UX operating systems
- Using HP and/or EMC storage arrays

Do **not** sell CASA when:

- Configuring mission-critical configurations
- Using single host/host cluster configurations
- Configuring primarily for data migration

What does CASA do?

The Continuous Access Storage Appliance is a hardware/software tool for moving data from one type of storage device to another and managing it. The CASA:

- Consists of two fully 100% redundant internal hardware nodes that have broad interoperability support for heterogeneous arrays and operating systems
- Provides customers with heterogeneous data replication to increase data availability
- Consists of two fully redundant active-active nodes that have broad interoperability support for heterogeneous arrays and operating systems
- Provides the capability of mirroring and creating snapshots (point-in-time images) across and between heterogeneous storage systems (EMC, HP)
- Provides the capability to migrate data between storage devices to facilitate removal of legacy equipment or to adapt data to different availability configurations when business needs change

CASA features

- Heterogeneous data replication
- Local Fibre Channel mirroring of disks
- Long-distance IP mirroring of disks
- Easy logical unit number (LUN) modifications
- Point-in-time copies or snapshots



Heterogeneous replication

- Heterogeneous replication across local and Fibre Channel mirroring can be implemented for business continuity and disaster recovery over wide area IPs.
- The CASA can facilitate backing up data on geographically dispersed SANs to a central location.
- The CASA supports heterogeneous host environments (major operating systems: HP-UX, Windows).
- The CASA can replicate from existing HP or non-HP high-end storage environments to either environments at a remote site

Local Fibre Channel mirroring of disks

Within the SAN, or an extended SAN, the CASA data mirroring feature allows fully synchronous data copies to be made. For near-instant point-in-time images, the CASA Vsnap feature is used. To replicate data over longer distances, the CASA has an IP gateway that allows appliances to be attached and connected to a LAN/MAN/WAN without the use of a storage router.

Long distance IP mirroring of disks

For business continuity and data protection, mirroring data to a remote location is a widely used method. This long-distance data mirroring solution requires a CASA at both the local and the remote location. A Gigabit Ethernet (GbE) port in each CASA provides an IP gateway from the SAN that is used to connect the CASAs to an IP-based network. This can be a dedicated network, a shared network, or even the Internet. Each CASA has two GbE ports available for long-distance mirroring, so for resiliency, two independent paths can be specified between the local and the remote CASA.

Easy LUN modifications

LUN access control includes

- Which locks in
- Who has what access
- What type of access to a LUN

For example, who has read only access, who has read/write access, and so forth. LUN resources are reallocated rapidly as business demands change. Up to 2000 LUNs from the connected storage systems can be managed by the CASA.

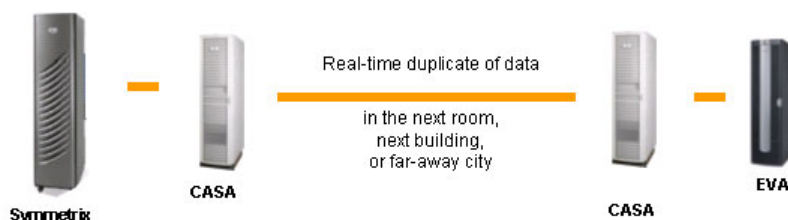
Point-in-time copies or snapshots

Using either the Fibre Channel-based or IP-based data mirroring, a virtual disk can be mirrored to a secondary storage system. The target virtual disk can be used as a source for Vsnapshots. These Vsnapshots can be used for online data recovery as well as for archiving data to tape. Because no host software is required, there is no impact on hosts' processing power.

EMC Symmetrix to HP StorageWorks EVA data replication

You can use the CASA data replication capabilities to penetrate Symmetrix environments and provide these customers with a “truly open” data replication solution. No longer will they be tied to an expensive, proprietary Symmetrix disk array. In these cases, you will be providing a solution that consists of a CASA for the Symmetrix environment, another CASA and a far less expensive HP disk array for their data replication site.

Symmetrix-to-EVA data replication



- A proprietary ‘locked-in’ EMC environment immediately becomes open by connecting some or all of Symmetrix ports to a CASA.
- CASA gives storage administrators greater flexibility in managing EMC storage and the capability to integrate capacity from EMC with capacity from HP and other vendors.
- CASA offers significant cost savings in EMC environments by taking copies off expensive EMC capacity to lower cost capacity.
- CASA remote replication is more affordable than SRDF.
- Today CASA supports Symmetrix 4, 4.8 and 5.0 architectures and Clariion FC4700, FC5700.
- Support for Symmetrix 5.5 and DMX architectures and Clariion CX600, CX400, CX200 is planned.

CASA competitors

- Single product companies (DataCore, FalconStor, StoreAge) do not offer the support and long-term security of HP and CASA.
- System vendors, such as IBM, are following HP to market with CASA-like products. These vendors are playing “catch up” and cannot match CASA functionality.
- Storage system vendors with replication capability will remain the sensible choice for certain applications but, for heterogeneous environments, the CASA offers much greater flexibility.
- Host-based software for data replication has value when designed for the job (OpenView SVR), but volume managers (VxVM) aspiring to be replication products are poor alternatives.

CASA interoperability

The CASA is primarily aimed at the HP-UX and Windows operating systems and HP and EMC array environments.

Operating systems

- HP-UX 10.20, 11.0, 11i,
- Solaris 2.6, 7, 8
- Windows NT 4.0 SP6a
- Windows 2000 SP2
- Windows 2003
- Linux Red Hat 7.1, 2.1, 8
- Linux SuSE SLES8
- Linux United 1.0 (32/64)
- AIX 4.3.3, AIX 5.1
- NetWare 5.1, 6.0

OVSAM 3.0

- Storage node manager
- Storage builder
- Storage optimizer
- Storage accountant

HP storage

- XP512, XP48, XP128, XP-
- VA 7100, VA 7400, VA7410
- MA8000 & EMA12000
- EVA3000/5000
- MSA1000
- FC60 (single path)
- XP 48-1024

HBA

- Qlogic 2200, 2202, 2302, 2310, 2342
- HP A6684A, A6685A, A5158A, A6795A
- Emulex LP8000, LP952
- JNI FC64-1063 (Sun S-bus)
- IBM FC6228

NAS

- E7000
- B3000

Host failover

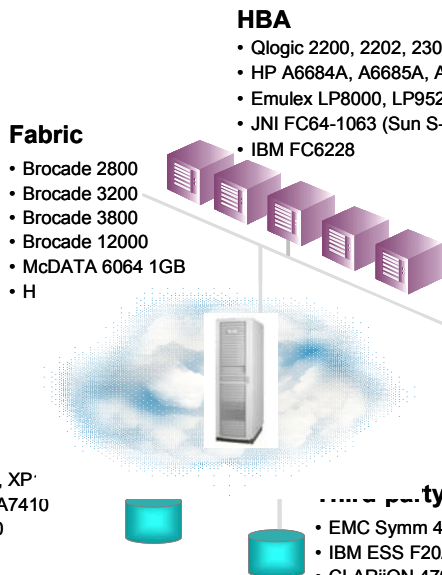
- AutoPath (Windows NT/2000)
- Secure Path
- Pvlinks (HP-UX)
- DMP (Solaris)
- Native (Linux)
- Native (NetWare)
- AutoPath for AIX

Array failover

- Included for:
 - HP XP, VA, EVA, MA, EMA
 - MSA
 - EMC
 - HDS
- Dell: ATF 2.20
- Clariion 4700: ATF 2.07
- Clariion 5700: ATF 2.20

..... party storage

- EMC Symm 4, 4.8, 5
- IBM ESS F20/2105
- CLARiiON 4700& 5700
- Hitachi 9200, 9900
- Dell PowerVault 650F



Field assistance

- Removing sales barriers (competition, interoperability, pricing, who to call)
CASA war room - svs-war-room@bra.exch.HP.com
- Internal CASA
information <http://storage.inet.cpqcorp.net/application/view/ProdCenter.asp?ProdCode=393>
http://www.hp.com/products1/storage/products/virtualization_appliances/network/sv3000/index.html
- Partner CASA information
https://partner.americas.hp.com/rrc/performance/html_src/search/search.cgi?search_str=CASA

Summary

Key points covered in this module include:

- Sell CASA when:
 - Mid-range configuration needs cost-effective data replication
 - Running Windows and HP-UX operating systems
 - Using HP and/or EMC storage arrays
- Do NOT sell CASA when:
 - Configuring mission-critical configurations
 - Using single host/host cluster configurations
 - Configuring primarily for data migration
- CASA features
 - A hardware/software tool for moving data from one type of storage device to another and managing it
 - Consists of two fully 100% redundant internal hardware nodes that have broad interoperability support for heterogeneous arrays and operating systems
 - Provides customers with heterogeneous data replication to increase data availability
 - Consists of two fully redundant active-active nodes that have broad interoperability support for heterogeneous arrays and operating systems
 - Provides the capability of mirroring and creating snapshots (point-in-time images) across and between heterogeneous storage systems (EMC, HP)
 - Provides the capability to migrate data between storage devices to facilitate removal of legacy equipment or to adapt data to different availability configurations when business needs change

Learning check

1. Which of the following describes a CASA appliance:
Mid-range storage array
Network gateway
Storage replication device
Storage interface to IBM mainframes
2. Which vendor is not supported by CASA?
 - a. HP-UX
 - b. EMC Symmetrix
 - c. Silicon Graphics Infinite Storage
 - d. Microsoft Windows
3. CASA is positioned for ongoing support of which operating environments?
 - a. Windows, HP-UX, and IBM AIX
 - b. HP-UX and IBM AIX
 - c. Windows and HP-UX
 - d. Windows, HP-UX, IBM AIX and Solaris
4. HP positions CASA to be sold when ____ (Select **two**):
 - a. A mid-range configuration needs cost-effective data replication
 - b. The customer is using HP and/or EMC storage arrays
 - c. Configuring mission-critical configurations
 - d. Single host/host cluster configurations
 - e. Configuring primarily for data migration

Objectives

After completing this module, students should be able to:

- Identify customer business needs that are addressed by the HP StorageWorks Virtual Array 7410.
- Describe the customer benefits of the Virtual Array 7410.
- Link Virtual Array 7410 features to business value components.
- List key Virtual Array 7410 system components.
- List software management components.
- Use appropriate questions to qualify opportunities in the SAN target market.

Customer business needs

HP VA7410 storage arrays make it possible, when deployed in a SAN environment, for customers to address their data needs and achieve significant business benefits.

Business needs

Mid-range SAN solutions offer many benefits to business class customers, and customers choose SANs for many reasons. Customer business needs for SAN solutions include:

- **HP-UX environment and heterogeneous support** — Customers can mix operating environments on the same storage network.
- **Server and storage consolidation** — Customers can consolidate storage in a single enclosure, which allows them to configure, manage, and maintain their storage resources more efficiently.
- **High availability** — Redundant communication paths allow for maximum uptime.
- **Rapid database growth and recovery** — Customers can expand the configuration without powering the system down using HP OpenView Storage Virtual Replicator.

By deploying SANs, customers can:

- Create strategies to simplify storage deployment and management
- Lower the total cost of ownership (TCO)
- Minimize staff resources/maximizing staff efficiency

Customer business need: HP-UX environment and heterogeneous support

Look for customers who mix HP-UX, Windows NT, Windows 2000, .NET, Sun Solaris, IBM AIX, Linux, NetWare, and MPE/iX (coming Q3'03) operating systems on the same storage network.

These customers:

- Have higher use of storage capacity
- Require ease of sharing storage devices without file corruption between server-specific storage sets

Customer benefits

- Simplifies storage management for heterogeneous environments
- Allows storage administrators to manage more storage with less effort
- Reduces the opportunities for human error
- Optimizes use of total storage capacity
- Creates strategies to simplify storage deployment and management
- Minimizes staff resources
- Reduces overall storage management costs
- Protects investment

Customer business need: server and storage consolidation

Look for customers with the following needs:

- Undergoing server consolidation
- Underutilized primary storage disks
- High number of dedicated tape drives
- Expensive management resources or inadequate staffing
- Poor application performance/slow file access
- Customers with ProLiant servers

Customer benefits

- Lowers the total cost of ownership (TCO)
- Reduces the time spent managing individual arrays
- Allows storage administrators to manage more storage with less effort
- Maximizes staff efficiency
- Reduces the opportunities for human error
- Frees up valuable IT resources to work on revenue-generating projects
- Helps create strategies to simplify storage deployment and management
- Reduces overall storage management costs

Customer business need: high availability

Look for customers:

- Who have business-critical databases, messaging/email, collaboration, web hosting, document imaging, or other mission critical applications that must sustain high availability
- Who want to eliminate points of failure between servers and storage subsystems
- Who have cluster servers with single and dual storage subsystems

Customer benefits

- 24x7 data availability to support mission-critical business operations
- Allows storage administrators to manage more storage with less effort
- Reduces the opportunities for human error
- Self-manages RAID configurations for optimum performance
- Maximizes staff efficiency

Customer business need: rapid database growth and recovery

Look for customers who:

- Need to add storage capacity quickly
- Have rapidly growing volumes of data either direct-attached or on a SAN that are increasingly difficult and time-consuming to back up
- Require faster application deployment
- Have no time to power-down systems
- Are required to maintain user productivity and access to data

Customer benefits

- Allows storage administrators to manage more storage with less effort
- Lowers the total cost of ownership (TCO)
- Self-manages the RAID configuration for optimum performance
- Simplifies storage management
- Provides 24x7 data availability to support mission-critical business operations
- Enables optimum use of total storage capacity

Solution: HP StorageWorks Virtual Array 7410

The HP StorageWorks Virtual Array is the first choice for mid-range SANs running HP-UX and for sharing storage from different operating system environments. It can scale up to 15TB.

The HP StorageWorks Virtual Array is a low-cost, high-capacity, high-performance, dual-port 2Gb/s Fibre Channel virtual disk array that delivers up to 99.95% uptime. It is an ideal choice for environments that require heterogeneous operating systems including HP-UX, other UNIX servers, and Wintel servers. Customers can mix and match drives of different sizes, and add capacity instantly. HP hot-swap technology and redundant components reduce planned downtime. The virtual array architecture simplifies management and administration of the array. File or LUN (logical units of storage) creation occurs quickly, without worrying about the underlying physical technology.

The HP StorageWorks Virtual Array 7410 supports over 15TB with up to 105 disks. The VA7410 has four host ports to enable simplified and more extensive server and SAN connectivity. These ports support either 1Gb or 2Gb Fibre Channel devices. With four back-end disk ports and faster array controllers, the VA7410 is capable of up to 31,000 cached I/Os per second and up to 330MB/s sequential throughput.

The VA7410 is an ideal virtual array for organizations that use HP-UX, Windows NT, Windows 2000, .NET, Sun Solaris, IBM AIX, Linux, or NetWare servers for business-critical operations, including online transaction processing (OLTP), file/print, Internet, and messaging applications. The VA7410 provide stress-free storage that your customers can depend on.



Business applications

- Database
- Messaging
- Collaboration
- Web hosting
- Document imaging

Key features

- **AutoRAID (RAID 1+0 and RAID 5DP)** — The virtual architecture is designed to dynamically store data in either high-performance RAID 1+0 mode or cost-effective RAID 5DP mode based on the I/O patterns of the applications. Most frequently used information is stored in RAID 1+0, and least frequently used information is stored in RAID 5DP. As usage patterns dynamically change, the virtual array adjusts the way data is stored to adapt—with the performance of RAID 1 and the cost of RAID 5.
- **RAID 1+0 striping of every LUN across all disks** — In a very large redundancy group, striping across all disks reduces the number of LUNs required to achieve a balanced workload and eliminates “hot spots.” This self-tuning performance assures consistency in meeting application service level agreements.
- **24x7 performance tuning** — The balancing between RAID levels occurs dynamically, without any human intervention. This eliminates downtime for reconfiguration to eliminate performance problems. This self-tuning performance also assures consistency in meeting application service level agreements.
- **Mirrored ECC cache** — The HP virtual storage architecture implements a tightly coupled mirrored-memory design. This provides greater availability and higher performance in shared environments.
- **Fibre Channel switch support** — Supports 8-, 16-, 32-, and 64-port FC switches operating at 1Gb; 8-, 16-, 32-, and 64-port FC SAN switches operating at 2Gb. This allows the full benefits of a SAN, providing exceptional connectivity while increasing the effective bandwidth of the network. Supported SAN features include zoning for communication isolation.
- **End-to-end checksum data** — With end-to-end checksum data, silent data corruptions cannot be passed from server to array or from array to server.
- **Hot-pluggable, redundant components** — Disks, power supplies, and fans are redundant, and can be replaced online. Virtual technology allows disks to be replaced in any location with disks of different sizes, eliminating a common data-loss scenario from service.
- **Active/active controller operation** — Any controller can access any data without performance penalty. This allows I/O load balancing. Each VA7410 has four Fibre Channel host ports that assure the availability of bandwidth for the most stringent applications. In addition, up to 2GB of cache per controller pair ensures high performance. Mirrored write-caching capability maintains optimal performance while assuring data integrity in the event of a failure
- **Metadata recovery** — The actual physical location of data is maintained in logical-to-physical maps in cache memory. These maps are periodically “checkpointed” and copied to disk, similar to database transactions and checkpointing.

- **Easy-to-use management tools** — Integration into management tools like OpenView allow web-based management anytime, anywhere.
- **Multivendor platform** — Support for industry-leading operating system platforms include Microsoft Windows NT, Windows 2000 (Advanced Server), Sun Solaris, HP-UX, IBM-AIX, Linux, NetWare, and MPE/iX (Q3'03).
- **Servers supported (single and clustered)** — ProLiant servers, HP servers, Sun servers, and IBM servers are supported.
- **Clustered server and high-availability system support** — Dual and multinode cluster support is provided for host level fault tolerance and high system availability.

Operating system	Cluster support
HP-UX	MC ServiceGuard
Sun Solaris	VERITAS Cluster and Sun Cluster
ProLiant	Microsoft Cluster Server (MSCS)
x86 platforms for Microsoft Windows NT Enterprise Edition and Windows 2000 Advanced Server	Microsoft Cluster Server (MSCS)
Novell NetWare	NetWare Cluster Server (NCS)
Linux	ServiceGuard
IBM AIX	HACMP

- **Multiserver shared support for storage consolidation** — Heterogeneous and homogeneous host support provides the ability to share storage between multiple servers. The virtual array provides LUN access control through Secure Manager, which ensures that a host cannot access data belonging to a different host. SAN-based data zoning is also supported.
- **Solution capacity** — The following table outlines the maximum capacity of the VA7410.

Model	Minimum Drives	Number of Drive Bays	Maximum Capacities (GB)		
			36GB	72GB	146GB
Virtual Array 7410	10	15	540	1,080	2,190
Virtual Array (1) 7410 + DS2405 expansion (1) VA7410 (6) DS2405 Expansion model	10	105	3,780	7,560	15,330

Supported disk drives

The VA7410 supports the following Fibre Channel disk drives:

- 10,000 rpm (146GB, 72GB, and 36GB)
- 15,000 rpm (72GB and 36GB)

Array-based virtualization

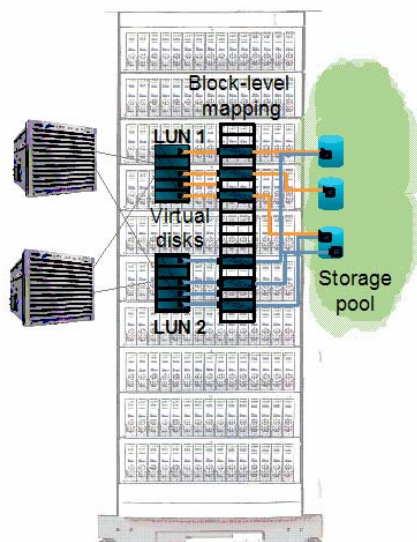
The purpose of virtualization in any technology is to hide complexity from the user. In the case of disk arrays, virtualization hides complexity from the storage administrator and provides a standard environment for application development and increased price:performance.

Virtualization in arrays creates and manages virtual storage devices. It takes blocks of storage on the disk drives and presents them as LUNs. Instead of seeing the actual physical disk drives, system administrators see a created, simplified “virtual” view of the actual physical storage—the LUNs.

Disk arrays are complex devices designed for complex tasks. A disk array with 50 disk drives is more complex to manage than a disk array with one drive. Armed with virtualization, an array could potentially allow the 50 drives to be perceived and managed as one big drive or as one big pool of storage. The power of virtualization is the power of simplification—it hides complexity from the administrator and can have a dramatic, positive effect on real-world performance. This reduction in complexity greatly simplifies and streamlines the data center environment.

With the Virtual Array 7410, virtualization:

- Reduces the time spent managing individual arrays
- Allows storage administrators to manage more storage with less effort
- Reduces the opportunities for human error
- Frees up valuable IT resources to work on revenue-generating projects
- Self-manages the RAID configuration for optimum performance



- Available storage treated as a single pool
- Mapping provides logical view of storage to host servers
- Data stored in different formats/locations to meet access requirements
- Data storage parameters can be adjusted when access requirements change

Virtual Array software

The HP StorageWorks Virtual Array 7410 supports a variety of software functions.

HP StorageWorks Command View SDM

HP StorageWorks Command View Storage Device Management (SDM) software is a host-based device management application that provides a common user interface for HP mid-range storage arrays.

Command View SDM monitors, manages, and diagnoses storage resources from a web browser or single system management console to provide centralized control of information resources at anytime from anywhere.

- **Powerful management capabilities**
 - Graphical representation of storage resources and status to increase administrator efficiency
 - Integration with HP OpenView Storage Area Manager to enable centralized management of HP mid-range storage devices from the HP OpenView SAN management console
 - SAN management console
 - Launches and manages HP StorageWorks Business Copy Virtual Array and Secure Manager Virtual Array value-added software
 - Active graphic displays and instant device health to quickly monitor the health of HP mid-range arrays
- **Increased data safety and availability**
 - Gain the highest availability and uptime
 - Configures LUNs, analyzes I/O performance, and establishes security
- **Easy management**
 - Common user interface (GUI, CLUI, CVUI, and web browser support) to allow device management anywhere, any way
 - Best-of-class management tools to ease tasks, reduce human error, and simplify training
 - Simplified management in simultaneous heterogeneous environments

HP StorageWorks Integration Pack

The HP StorageWorks Integration Pack enables enterprise network and system management tools to monitor the virtual arrays using SNMP from the management console.

Integrations for the leading network and system management tools are contained on a single CD and enable the administrator to monitor, diagnose, and be informed of potential problems before system availability is affected.

■ **Compatibility**

- Supports HP OpenView Network Node Manager for HP-UX 11.0, Windows NT 4.0, and Windows 2000
- Supports CA Unicenter-TNG for HP-UX, Windows NT 4.0, and Windows 2000
- Supports Tivoli NetView
- Supports BMC Patrol
- Supports HP Top tools 4.5 and 5.0
- Compatible with the HP StorageWorks Virtual Array family
- Supports HP SEMI 1.0 agent for HP modular storage and tape devices

■ **Easy to install**

- Plug-and-play
- Automated custom scripts
- Automatic discovery of supported storage devices by the network management application

■ **Easy to manage**

- Device event communication uses SNMP for Windows 2000 and Windows NT 4.0 environments
- Changes in device status are represented by the device icon that can launch the device software for further diagnostics or configuration status

HP StorageWorks Secure Manager Virtual Array

HP StorageWorks Secure Manager Virtual Array is an array-based software solution that provides customers with the ability to secure LUNs used in production and test environments. LUNs can be configured in a mixed heterogeneous environment to ensure that any operating system can lock data volumes or LUNs into the host operating system environment and restrict access from other intrusive operating systems, such as Windows NT or Windows 2000.

This is an ideal product for customers who need to secure data in a shared environment. Secure Manager VA allows a user to create secure LUNs with 128 World Wide Name (WWN) connections for the HP StorageWorks Virtual Array 7410. It provides a simple, cost-effective way to administer data security within the array.

- **Efficient and flexible**
 - Secures business-critical data in parallel by WWN and by LUN to enhance efficiency and cost-effectiveness
 - Quickly and easily configures security within the virtual array by simply changing permissions on volumes and/or connections while the array is online
- **Management-friendly** — Simplifies tasks with the easy-to-use Command View SDM interface for establishing secure volumes
- **Compatible** — Fully integrated with Command View SDM and the HP StorageWorks Virtual Array family of hardware and software products for interoperability across the spectrum of future virtual array storage solutions

HP StorageWorks Business Copy Virtual Array

HP StorageWorks Business Copy Virtual Array allows customers to create nondisruptive, high-performance, local business copies of any active application volume or LUN within the array, while benefiting from full RAID protection for the business copies. These LUN copies can be used by another application or system for a variety of purposes, including batch processing and backup.

Business Copy Virtual Array is a vital piece of the HP virtual array software portfolio and the HP StorageWorks Virtual Array family of solutions for applications such as data warehousing and decision support. When used in combination with HP OpenView Data Protector, Business Copy Virtual Array is the key enabler of a comprehensive offline or online backup solution.

- **Efficient and flexible**
 - Executes IT operations on business-critical data in parallel to enhance efficiency and cost-effectiveness
 - Meets business objectives quickly and easily by instantly creating point-in-time copies of source LUNs, scheduling backup activities, and maintaining I/O host performance
 - Enables all LUN creation and activity to be handled directly by the array
 - Provides fast online restores from business copy LUNs
- **Management-friendly** — Simplifies tasks with the easy-to-use interface for establishing business copy volumes and monitoring and maintaining volume status
- **Compatible**
 - Fully integrated with Command View SDM and the virtual array family of hardware and software products for interoperability across the spectrum of future virtual array storage solutions
 - Complements HP OpenView Data Protector, VERITAS, Legato, and other backup applications for centrally managed and controlled backup recovery
 - Allows full automation of the backup application because of its powerful scripting compatibility

HP StorageWorks Auto Path Virtual Array

HP StorageWorks Auto Path Virtual Array provides key data availability, performance, and ease-of-use benefits to keep your customers' companies up and running 24x7. Auto Path Virtual Array provides multipath failover capability and load balancing of all I/O data paths to the virtual array.

Auto Path Virtual Array is a vital piece of the HP virtual array software portfolio and the HP StorageWorks Virtual Array family high-availability solution. Auto Path Virtual Array offers completely automatic host bus adapter (HBA) failover for supported Windows MSCS configurations and MC/ServiceGuard configurations.

- **Automatic error detection and failover** — Minimizes planned and unplanned downtime
- **Dynamic load balancing over multiple paths**
 - Improves performance
 - Increases the return from server investments
- **Excellent compatibility**
 - Works with Windows 2000 and existing Windows 2000 MSCS infrastructure
 - Works with Windows NT 4.0 and existing Windows NT 4.0 MSCS infrastructure
 - Works with Windows Server 2003
 - Works with Red Hat Linux 7.1
 - Works with HP-UX 11.0 and 11i using existing MC/ServiceGuard infrastructure
 - Supports the HP virtual array architecture
 - Provides maximum investment protection, performance, and scalability.

Note

You should check the VA7410 documentation to determine the latest products supported.

- **Easy to configure and manage** — Provides automated configuration with simple installation
- **Graphical management** — Provides graphical management to simplify administration

Solution: HP StorageWorks Disk System 2110

The HP StorageWorks Disk System 2110 (DS2110) delivers an industry-leading, high-capacity 1U storage solution. This entry-level, rack-optimized enclosure features open system compatibility with multiple operating system support, and offers the industry's lowest cost of entry. Because it is built with the HP commitment to developing dependable products and service, the HP StorageWorks Disk System 2110 ensures data integrity and manageability.

The DS2110 has four hot-pluggable slots, with individual disk capacities from 18GB to 146GB. The DS2110 capacity can exceed 500GB with 146GB drives. It provides 160MB/s transfer speed, all in a compact 1U package.

Features

- **Large storage capacity in a very small footprint** — Optimizes rack space with up to 584GB of storage capacity in a 1U enclosure; up to 24TB in a 2-meter rack
- **Serviceable** — Makes repairs simple with hot-swappable disks
- **Performance** — Supports U160 SCSI interface
- **Disk support** — 18GB/15K; 36GB/10 and 15 K; 73GB/10 and 15 K, and 146GB/10K
- **Compact** — 1U form factor minimizes footprint
- **Scalable** — Scales up to 12 disk drives (over 1.75TB) per host bus adapter to accommodate growing storage needs
- **Open** — Supports multiple operating systems, including HP-UX, open systems UNIX, Linux, NetWare, MPE/iX, Windows NT/2000, and Windows 2003
- **High availability option** — Can be configured easily to provide an inexpensive host-based mirrored storage solution or a low-cost RAID solution when used with a PCI disk array controller or a software RAID product
- **JBOD option** — Quick and easy storage capacity with no RAID configuration

HP StorageWorks disk systems

HP StorageWorks disk systems provide additional storage for capacity demands in rack-mount and desk-side models.

The DS2110 and DS2100 use and support the same disks (18GB/15K, 36GB/10 and 15 K, and 73GB/10 K) with two notable exceptions: the DS2110 supports the 73GB/15K and the 146GB/10K, whereas the DS2100 does not support these two disks.

Type	Interconnect	Disk slots	Operating systems
Disk System 2110	Ultra 160MB/s	4	HP-UX, MPE, Windows NT, Windows 2000, Windows Server 2003, Linux, NetWare, SCO OpenServer, SCO UnixWare
Disk System 2100	Ultra160 SCSI	4	HP-UX, MPE, Windows NT, Windows 2000, NetWare, Solaris, AIX
Disk System 2300	Ultra160 SCSI	14	HP-UX, MPE, NetWare, Linux
Disk System 2405 (for VA7xxxx expansion))	Fibre Channel 15 2Gb/s upgrades to virtual array	15	XP-UX, Windows NT, Windows 2000

Note

The DS2110 was announced in Q403 as providing support for Ultra320 drives. Due to an engineering defect, this support is not yet available.

As of Q104 and Q204 the DS2110 will continue to support Ultra160 drives only.

The existing DS2100, DS2110, and DS2300 will **not** support U320 drives.

In Q304, HP will announce a DS2120 that will support Ultra320 drives.

Customer benefits of StorageWorks Virtual Array 7110 and 7410

- Simplified storage management for heterogeneous environments
- Reduced overall storage management costs
- Investment protection
- 24x7 data availability to support mission-critical business operations

Selling value — qualifying questions

The following questions may be helpful in articulating the customer benefits of the StorageWorks Virtual Array 7110 and 7410:

- Are you running business applications on HP-UX as well as other operating systems, and want to protect your investments?
- Do you want to increase storage utilization by sharing storage resources between servers with heterogeneous operating systems?

Qualifying questions

When qualifying a customer, the following questions may be helpful to determine whether a VA7410 solution would be appropriate:

- Is your business growing and experiencing increased volumes of data, and you need to add capacity quickly without business disruption?
- Are you running business applications on HP-UX as well as other operating systems, and want to protect your investments?
- Is access to data critical for continuous business operations?
- Are your systems managers noting performance issues for data access and retrieval?
- Would you want to increase storage utilization by sharing storage resources between servers with heterogeneous operating systems?
- Do you need to manage your storage more effectively by reducing backup recovery times to improve availability, and increase your flexibility?
- Are you under regulatory requirements for archiving data?
- Is your IT staff managing multiple backup systems?
- Do you support HP-UX and multiple operating systems in your storage environment?

Summary

Virtual Array 7410 satisfies customer business needs for:

- HP-UX environment and heterogeneous support
- Server and storage consolidation
- High availability
- Rapid database growth and recovery

Virtual Array software consists of the following products:

- HP StorageWorks Command View SDM
- HP StorageWorks Integration Pack
- HP StorageWorks Secure Manager Virtual Array
- HP StorageWorks Business Copy Virtual Array
- HP StorageWorks Auto Path Virtual Array

Customer benefits include:

- Simplified storage management for heterogeneous environments
- Reduced overall storage management costs
- Investment protection
- 24x7 data availability to support mission-critical business operations

Learning check

1. A customer who has a business need to eliminate points of failure between servers and the storage subsystems would be interested to learn about the VA7410s _____.
 - a. Storage consolidation features
 - b. Ability to support both HP and heterogeneous environments
 - c. Ability to support environments whose data storage requirements are growing rapidly.
 - d. Ability to support environments that require high availability access to information.
2. The VA7410 can support up to ____ disks.
 - a. 24
 - b. 75
 - c. 105
 - d. 125
3. Which of the following is **not** a customer benefit of an entry-level SAN solution?

Makes it possible to create strategies to simplify storage deployment and management

Protects critical applications in a JBOD environment

Lowers the total cost of ownership

Minimizes requirements for staff resources
4. HP StorageWorks Auto Path Virtual Array contributes to which of the following customer business needs?
 - a. Disaster recovery
 - b. Data protection
 - c. I/O multi-path failover
 - d. Virtualization

5. Match the feature of the VA7410 with the business need that it addresses.

- a. Heterogeneous support
- b. Server and storage consolidation
- c. High availability
- d. Rapid data base growth and recovery

_____ Customers can combine storage disks of different sizes within a single enclosure.

_____ Integration with upper-level enterprise management tools like HP OpenView Storage Secure Path allow for maximum uptime.

_____ Support for industry-leading operating system platforms include Microsoft Windows NT, Windows 2000 (Advanced Server), Sun Solaris, HP-UX, IBM-AIX, Linux, NetWare, and MPE/iX.

_____ The ability to quickly add storage capacity

Objectives

After completing this module, students should be able to:

- Identify enterprise NAS target customer characteristics and their challenges.
- Describe the benefits of NAS solutions.
- Link HP StorageWorks NAS features with business value.
- Use appropriate questions to qualify opportunities in the NAS target market.

Overview

This module addresses network attached storage (NAS) solutions, specifically NAS appliances—dedicated server storage systems attached to a local area network that can provide shared storage between heterogeneous clients.

NAS systems are better suited for static data that does not require high performance levels. This generality is now changing somewhat as file systems improve and databases improve in their ability to do file I/O. NAS provides customers with a relatively easy and low-cost way to move from DAS to SAN.

Some customers, however, are comfortable with Internet Protocol and do not want to install a Fibre Channel network for storage. Other customers are using NAS in data centers despite warnings that network latency renders a NAS solution too slow for database environments—particularly in production environments that require even modest amounts of write I/O activity. HP can consult with customers on their business criteria and offer customers both NAS and SAN solutions.

Key products and concepts

This module introduces the following products:

- HP StorageWorks NAS 4000s
- HP StorageWorks NAS 9000s
- Microsoft Volume Shadow Copy Service
- HP OpenView Storage Mirroring (optional software)

NAS servers versus general purpose servers

The following table lists some of the benefits of a NAS server as opposed to building a general purpose server for multiprotocol file serving.

Attribute	HP StorageWorks NAS	General-purpose server
Ease of deployment	System image preinstalled, remote discovery and install utility, configurations wizards, appropriate drivers preinstalled.	All software components have to be installed by end user — configuration and tuning done by end user.
NAS software stack — data management tools	NAS software preinstalled — includes all software needed for high-availability file serving while still allowing the addition of company standards for things like backup and antivirus.	All software pieces for file serving have to be sourced individually and managed separately on the running system.
Rapid restore	Rapid Restore CD/DVD simplifies recovering to factory settings after a catastrophic failure.	In the case of a catastrophic failure, the system has to be built up piece by piece (that is, add the operating system, then snapshot, and then replication and so on).
Preconfigured hardware	Processor, memory, and NIC are balanced for price:performance and preconfigured in the system.	Customer needs to spend time testing and determining the right combination of hardware.
Software licenses	Unlimited user licenses are included with HP NAS products.	Customer either has to pay for user licenses or have them count against a site license count.
Single point of support	With an HP NAS product, the customer can work directly with HP for all aspects of support — hardware and software.	Customer needs to go to hardware vendor and different software and option vendors for support.
Pricing discount	Hardware pricing is based on a slight discount based on building a ProLiant server and adding options — the user licenses are not included in pricing buildup.	Priced as individual components — add all additional hardware and software options including user licenses.

Typical uses for NAS and SAN

Here are the typical usage models for NAS and SAN.

NAS	SAN
<ul style="list-style-type: none"> ■ Office applications file serving ■ File sharing between office users and CAD users ■ Print server consolidation ■ Content management for web servers ■ Consolidation of “home directories” for controlled and centralized backup ■ Data replication over standard Ethernet ■ Boot device for diskless server farms ■ Rich media such as audio or video streaming 	<ul style="list-style-type: none"> ■ Physical storage consolidation of any application mix ■ Physical storage sharing for cluster configurations ■ Sharing of backup devices (libraries) ■ Long distance data replication on storage device level ■ Redundant, high-speed disk access for large database servers

When to use network attached storage

The HP StorageWorks NAS 4000s has been designed to serve files to heterogeneous clients. In addition to performance tuning, the HP StorageWorks NAS 4000s includes integrated software designed to support a multi-protocol environment, snapshots, replication, and volume expansion.

- NAS solutions enhance a customer’s networked storage capabilities by connecting into the existing network infrastructure allowing heterogeneous file serving and print services.
- Another common need for NAS is to address multiprotocol file serving requirements. Because NAS provides the ability to share files over multiple protocols, customers can use a single solution for heterogeneous environments instead of using different file servers for different client operating systems. Cost and management savings abound in these situations.
- An emerging use for NAS is in protocol and platform transitions. Migrations are simpler if data is held in a centralized location. The multiprotocol nature of NAS also allows a seamless transition period for clients as they are migrated to new systems.
- For customers concerned about business critical data, data replication support is now available for NAS.
- Finally, with the introduction of turnkey, low-end NAS systems, retail stores, bank branch offices, and doctors’ offices are finding that NAS is ideal for storing point-of-sale file data, teller document shares, and medical images and data. In many cases, data replication utilities are used to transfer and synchronize data to a centralized corporate location.

There are many other uses for NAS in several different market segments, such as technical computing, CAD/CAM, education, and media streaming. Basically, if it’s file-based, NAS can help.

Business needs for NAS

There are several needs that enterprise NAS solutions address including:

- **Low-cost networked storage** — Serves files to the network with unused SAN storage.
- **File/server consolidation** — Customers want to protect their NAS investment and better utilize their SAN by merging NAS and SAN resources.
- **Heterogeneous protocol support** — Allows simultaneous support for Windows NT, UNIX, NetWare, and Macintosh files.
- **Dynamic growth and recovery** — NAS provides for fast application deployment. Use of snapshot feature avoids unnecessary downtime and protects against data loss.
- **Improved service levels** — NAS enables simplified, centralized management.
- **High availability and disaster recovery** — Remote data replication feature makes it easier for customers to recover from disaster quickly.

Target customers

Target customers for NAS include branch offices and retail stores as well as large corporations with remote or regional offices that need to consolidate storage into a single, cost-effective repository for easy, efficient management.





Target industries

NAS solutions are used in many industries.

- CAD/CAM
- Medical imaging
- Media, broadcasting, entertainment
- Software developers
- ISP, SSP, web and application hosting

HP StorageWorks NAS Windows Storage Server 2003 family

In Q104, HP expanded its Windows Storage Server 2003 family offerings.

StorageWorks NAS 1200s	StorageWorks NAS 2000s	StorageWorks NAS 4000s	StorageWorks NAS 9000s
Remote office, small and medium business	Departmental, remote office	Enterprise, large departmental	Enterprise
Fixed configuration, ATA based storage	Scalable, SCSI attached storage	Entry-level NAS/SAN fusion	Flagship NAS/SAN fusion
			
Appliance		Scalable	

Function	Old NAS solution	Current NAS solution
Operating system	Windows-powered operating system	Windows Storage Server 2003
Snapshots	Persistent Storage Manager	Microsoft Shadow Copy Service (VSS)
Data replication	NAS Data Copy	HP OpenView Storage Mirroring (optional)
Clustering	2-node (NAS b3000)	8-node (NAS 4000s and NAS 9000s)
Print services	Not supported	Supported
Processor speed	2.8 GHz/	3.2 GHz
Naming	<ul style="list-style-type: none"> ■ NAS 1000s ■ NAS b2000 ■ NAS b3000 ■ NAS e7000 (software kit available for upgrading to NAS 9000s) 	<ul style="list-style-type: none"> ■ NAS 1200s ■ NAS 2000s ■ NAS 4000s ■ NAS 9000s

Windows-powered NAS market

According to Gartner *Dataquest*, Microsoft-powered NAS unit shipments grew 94% from 2001 to 2002, boosting market share from 19% to 38%. In contrast, proprietary NAS shipments declined by 36% in the same period from a market share of 79% to 53%. In the first quarter of 2003, Windows-based NAS captured 41% of total unit shipments. [*Storage Networking World*, July 2003]

Customers cite three main reasons for choosing Windows-powered NAS over proprietary devices: cost savings, ease of use, and functionality. In addition, Windows-based NAS devices are easy to manage and easy to maintain because the staff is already familiar with the operating system. To take best advantage of this market, HP is standardizing on Windows for its NAS offerings.

Windows Storage Server 2003 operating system

The Windows Storage Server 2003 operating system allows original equipment manufacturers (OEMs) to build appliances (such as the HP StorageWorks NAS 2000s) optimized for file serving, since applications unnecessary to the file serving and storage tasks are not activated. Windows Storage Server 2003 offers integrated storage services and also provides manageable, reliable, and cost-effective solutions designed to meet customers' challenges. New to Windows Storage Server 2003 are the following:

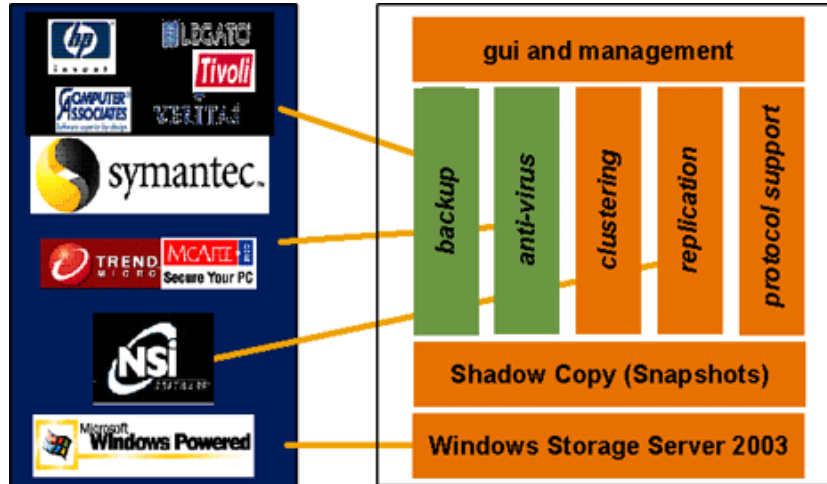
- **Volume Shadow Copy Service (VSS)** — Enables effective data protection, system management, and cost control
- **Virtual Disk Service (VDS)** — Enables storage solutions that are scalable, fault-tolerant, and manageable
- **Automated System Recovery (ASR)** — For rapid disaster recovery
- **Internet SCSI (iSCSI)** — Provides storage solutions that are scalable, manageable, and cost-effective
- **Multipath Input/Output (MPIO)** — Provides highly available data and fault tolerance

Improved management

- Based on ProLiant hardware, HP StorageWorks array technology, and Microsoft Storage Server 2003
- HP NAS rapid launch utility allows quick and simple installation
- Multiple management options are included for flexibility
 - Web based
 - Console based
 - iLO based
- Array configuration utility allows quick and seamless online volume growth
- Host-based data replication is provided as a trial, supported by HP

NAS architecture

The NAS 1200s, 2000s, and 4000s are built on the same software stack optimized for Windows environments. The benefit is that standard backup, snapshots and data replication are supported.



HP StorageWorks NAS and Windows Storage Server 2003 advantage

Best economics

- Low entry cost — low \$/GB ratio
- Low installation cost
- Reduced operation costs
 - Reduces server management cost (consolidation)
 - Centralized management control for backup, restore, upgrades (reduces overhead)
- Improved performance
- Scalable solution to grow with the business — pay as you grow

Integrate seamlessly

- Designed for easy integration in the IT environment
 - Preconfigured solution
 - Browser-based installation
 - Plug and play with network
- Leverages existing IT environments
 - Supports CIFS, NFS, AppleTalk, and others
 - Complete and seamless AD integration
 - Support standard management and utilities
 - Easy to integrate with SAN (NAS/SAN fusion)
- Depth of ISV partners
 - Software architecture: antivirus software, management software, snapshots, data replication

Dependable

- Designed for reliability and high availability
 - Dedicated for file serving, reducing potential points of failure
 - Native clustering with MSCS
- Availability of data
 - Volume Shadow Copy Service (VSS)
 - ◆ Up to 512 point-in-time copies per system (hardware provider), both scheduled and policy driven
 - ◆ Recover data in seconds (including end user level)
 - ◆ Back up from copies
 - Distributed File System (DFS)
 - ◆ Virtualizes namespace
 - ◆ Maintains data replicas and availability

Customer business need: file serving using SAN storage

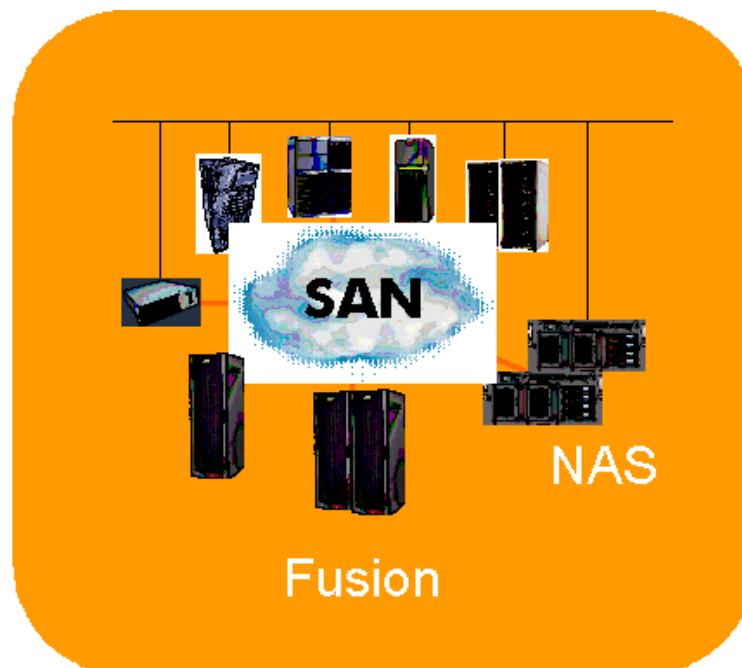
Look for customers who:

- Want to improve operational efficiencies by serving files to the network from unused SAN storage

Solution: fusion of NAS and SAN

Having the flexibility to share SAN resources with NAS systems increases storage utilization rates and creates greater ROI for customers. Combining NAS and SAN resources:

- Enhances NAS with SAN scalability and management
- Enhances SAN with file-level access and virtualization
- Converges storage islands
- Reduces overall management complexity
- Drives down cost



Customer business need: file/server consolidation

Look for customers who:

- Want a low-cost network storage solution without full SAN investment
- Want to grow storage capacity while better utilizing SAN infrastructure
- Want to optimize file serving performance
- Want to avoid unnecessary downtime in order to maintain user productivity levels
- Want to protect against losing files by performing scheduled snapshot backups

Solution: HP StorageWorks NAS 4000s

The HP StorageWorks NAS 4000s delivers a NAS solution for enterprise-level availability, scalability, and performance. It is the solution for businesses that need server/storage consolidation with connectivity to a medium-sized SAN. The fusion of NAS and SAN in a common, networked storage pool means that customers have the flexibility to choose file (NAS) or block (SAN) level access for business-critical applications. The NAS 4000s scales to 48TB with 146GB universal drives. It supports many HP StorageWorks arrays for back-end storage, including EVA3000 and MSA1000 arrays.

Key features

- **Capacity** — The NAS 4000s scales up to 48TB. With the new MSA1000-embedded 8-port switch, this solution scales up to 48TB. Supported arrays include EVA, XP, EMA, MA, VA, and MSA1000.
- **NAS/SAN fusion** — The NAS 4000s takes advantage of selective storage presentation (SSP) for access and utilization of both file and block level data.
- **Microsoft Volume Shadow Copy Service** — Shadow copies are complementary to tape backups and allow IT managers to restore on demand accidentally corrupted or deleted files without having to perform a lengthy tape backup and recovery.
- **HP OpenView Storage Mirroring** — Storage Mirroring provides near-real-time full application or file recovery up to the last byte replication. Ordered separately.

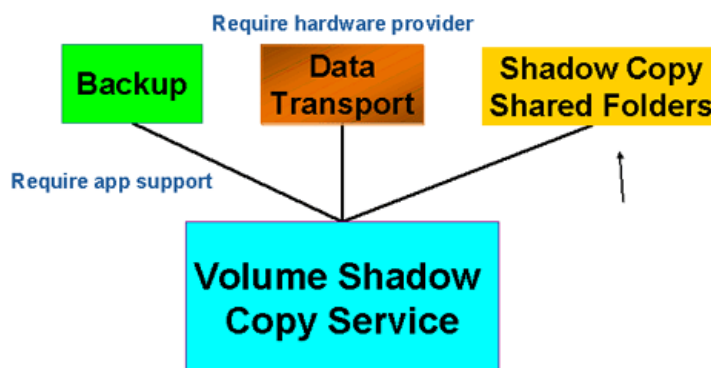
NAS 4000s technical specifications

Feature	Description
Processor	Two Intel Xeon 3.2 GHz processors
Cache memory	512-KB level 2 ECC cache and 1 MB Level 3 Cache
Memory	2GB standard (expandable to 6GB) ECC SDRAM memory
Network controller	Two integrated NC7781 PCI- X gigabit NICs
Expansion slots	Three available 64-bit slots: <ul style="list-style-type: none"> ■ 64-bit/100MHz hot-plug (two available) ■ 64-bit/133MHz Non-hot-plug (one available)
Storage controller	Integrated Smart Array 5i plus controller (dual channel, Ultra3)
Optical drives	Diskette drive — 1.44MB DVD-ROM — slim line
Hard drive (internal storage)	Standard two 36.4-GB 10,000 rpm U320 Universal Hard Drives (1") (for mirrored OS internal to server) Note: Maximum of two hard drives are supported. Hard drives are for user data and are based on the SAN chosen.
Form factor	Rack (2U = 3.5 inches)
Print services	Single device for networked file and print services (no direct attached printing)
Software	<ul style="list-style-type: none"> ■ Windows Storage Server 2003 ■ Microsoft Volume Shadow Copy Service (VSS) ■ CDP Persistent Storage Manager ■ Rapid launch ■ Web-based configuration utility ■ Array configuration utility ■ Secure Path ■ SmartStart ■ Insight Manager 7 ■ Management Agents ■ Active Update™ ■ ROMPaq™, support software and configuration utilities ■ Survey Utility™ and diagnostic utilities ■ Optional ProLiant Essentials Value Packs ■ HP OpenView Storage Mirroring.
Cluster support	Up to 8 nodes
Operating system support	Windows Storage Server 2003 (operating system and all software needed for storage management is preconfigured from the factory)
Array support	EVA, XP, VA, MSA1000, MA, EMA

VSS non-disruptive backup

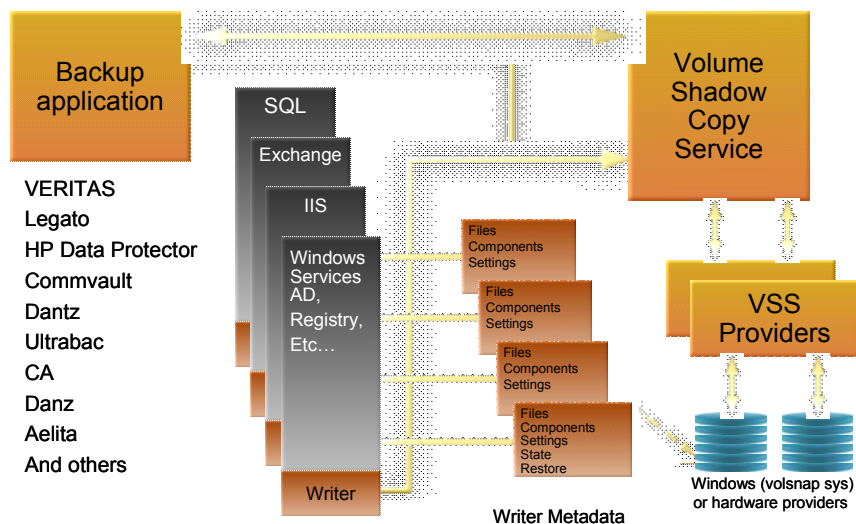
The Windows Storage Server 2003 operating system uses the Microsoft Volume Shadow Copy Service (VSS) for creating snapshots of single or multiple volumes.

VSS can schedule up to 64 shadow point-in-time snapshots per volume. Shadow copies are complementary to tape backups and allow IT managers to restore accidentally corrupted or deleted files on demand without performing a lengthy tape backup and recovery. This can be a crucial capability for customers with 24x7 operations who cannot use night time as a backup window. However, shadow copies are not likely to replace backups, which should still be run at least once a day for most environments.



VSS and SCSF application-aware backup

Shadow Copy Shared Folders (SCSF) enables administrators to configure point-in-time copies of critical data volumes without service interruption. SCSF lets end-users retrieve archived versions of their documents that are invisibly maintained on the NAS device.



Solution: HP StorageWorks NAS 9000s

The HP StorageWorks NAS 9000s solution fuses NAS with SAN technologies. It combines the simplicity of NAS with the scalability of SAN—setting new standards in performance, flexibility, and consolidated management. Simplifying centralized storage and system management saves resources and time, and lowers TCO. The NAS 9000s meets the needs of many business applications by providing enhanced storage and system management performance.

The fusion of NAS and SAN in a common networked storage pool means that customers have the flexibility of choosing file (NAS) or block (SAN) level access for business-critical applications. With virtually unlimited storage scalability, customers can grow their storage infrastructure as their business grows—without downtime and without compromising performance. The NAS 9000s solution ensures that data is always available, maintaining business continuance through cluster support, hardware redundancy, and replication.

Key features

- **Capacity** — The NAS 9000s is virtually limitless in the fact that it is dependent on the storage array chosen for connection to the NAS head. Supported arrays include EVA, XP, EMA, MA, VA, and MSA1000.
- **NAS/SAN fusion** — The NAS 9000s takes advantage of selective storage presentation (SSP) for access and utilization of both file and block level data.
- **Microsoft Volume Shadow Copy Service** — Shadow copies are complementary to tape backups and allow IT managers to restore accidentally corrupted or deleted files on demand without performing a lengthy tape backup and recovery.
- **HP OpenView Storage Mirroring** — Storage Mirroring provides near-real-time full application or file recovery up to the last byte replication. Ordered separately.

NAS 9000s technical specifications

Feature	Description
Processor	Two Intel Xeon 2.8 GHz processors (up to four supported)
Cache memory	2MB integrated level 3 cache
Memory	2GB 200MHz double data rate (DDR) SDRAM (PC1600 registered SDRAM memory with advanced ECC functionality) Maximum 26GB (standard memory with optional memory) or 32GB (standard memory replaced with optional memory)
Network controller	HP NC7170 dual port PCI-X 1000T gigabit server adapter (in a slot)
Expansion slots	Three available 64-bit slots: <ul style="list-style-type: none"> ■ 64-bit/100MHz hot-plug (two available) ■ 64-bit/133MHz Non-hot-plug (one available)
Storage controller	Integrated Smart Array 5i plus controller (dual channel, Ultra3)
Optical drives	Diskette drive — 1.44MB DVD-ROM — slim line
Hard drive (internal storage)	Standard two 36.4GB 10,000 rpm U320 universal hard drives (1-inch) (for mirrored operating systems internal to server) Note: Maximum of two hard drives are supported. Hard drives are for user data and are based on the SAN chosen.
Print services	Single device for networked file and print services (no direct attached printing)
Form factor	Rack (4U = 7 inches)
Software	<ul style="list-style-type: none"> ■ Windows Storage Server 2003 ■ Microsoft Volume Shadow Copy Service (VSS) ■ CDP Persistent Storage Manager ■ Rapid Launch ■ Web-based configuration utility ■ Array configuration utility ■ SecurePath ■ SmartStart ■ Insight Manager 7 ■ Management Agents ■ Active Update™ ■ ROMPaq™, support software and configuration utilities ■ Survey Utility™ and diagnostic utilities ■ Optional ProLiant Essentials Value Packs ■ HP OpenView storage mirroring.
Cluster support	Up to 8 nodes
Operating system support	Windows Storage Server 2003 (operating system and all software needed for storage management is preconfigured from the factory)
Array support	EVA, XP, VA, MSA1000, MA, EMA

Customer benefits of StorageWorks NAS 4000s and 9000s

- Integration of file or block data leads to increased efficiency of the storage network
- Unlimited scalability (NAS 9000s)
 - Grow storage capacity as business grows—without downtime and without compromising performance
- Continuous data availability
 - Ensure that data is always available, enabling business continuance
 - Clustering support for system failover
 - Hardware redundancy
 - Host-based file replication
 - Incremental backup capability with snapshots enables better utilization of system resources
 - Antivirus support
- Return on investment
- Simpler management of file or block level data leading to decreased costs for storage management
- Snapshots provide
 - Improved storage capacity utilization
 - Simplified management
 - Better utilization of system resources
 - Flexible storage deployment
 - Business flexibility
 - Improved availability

Customer business need: high availability and disaster recovery

Look for customers who:

- Have minimal onsite IT support and need remote management
- Have minimal infrastructure costs and a minimal level of disaster tolerance and disaster recovery requirements
- Are not looking for a Fibre Channel SAN solution or investment cost of a SAN infrastructure
- Want a cost-effective way to replicate file and print data that is easy to deploy and support
- Cannot work without access to the latest data
- Can measure the impact of lost access in productivity and/or lost revenue

Note that productivity directly translates to storage creation.

- Can directly measure impact (cost) of lost storage
- 1 hour = lost productivity of 100 people at \$40/hour each= [fill in the blank]

Solution: HP OpenView Storage Mirroring

HP OpenView Storage Mirroring (formerly NAS Data Copy) is an entry-level, host-based application that performs remote replication over an IP LAN/WAN. Storage Mirroring runs on a WinTel server with Windows 2003/2000/NT operating systems.

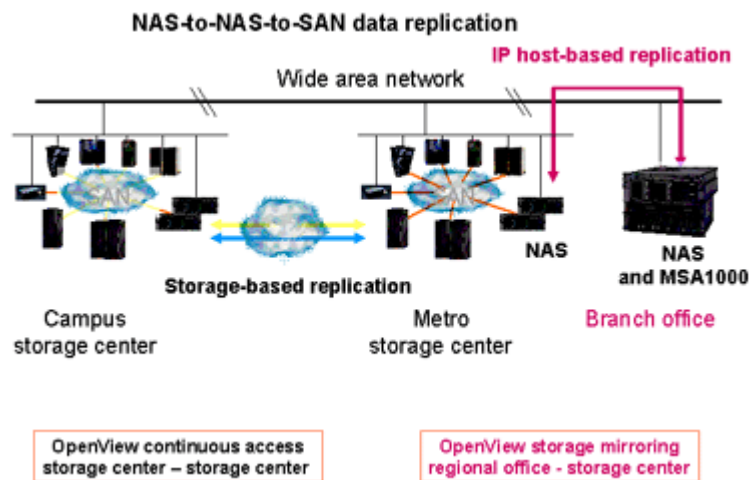
Storage Mirroring does not require high-bandwidth Fibre Channel networks, high-capacity replication, and zero downtime service levels. Storage Mirroring does provide near-real-time full application or file recovery up to the last byte replication. It is an excellent choice for low-bandwidth, low-storage volume changes and meets business recovery goals within tens of minutes or hours. The immediate return on investment is realized in the reduced management costs associated with branch or small offices networks.

Storage Mirroring allows customers to specify data that must be protected. It then replicates, in real-time, the specified data from a production machine, known as the source, to a backup machine, known as the target. The target machine, on a local network or at a remote site, stores the copy of the critical data from the source.

Note: HP OpenView Storage Mirroring software is ordered separately from NAS systems.

Storage Mirroring monitors any changes to the critical data and sends the changes to the target machine. By replicating only the file changes rather than copying an entire file, Storage Mirroring allows customers to more efficiently use resources and implement various data protection solutions including:

- Local high availability services
- Off-site disaster recovery services
- Enhanced centralized backup using third-party backup systems



Customer benefits of HP OpenView Storage Mirroring

- Reduces operational costs and replicates data over any IP network
- Business continuance solutions from the branch office to the storage center
- Low cost of entry for branch offices
- Migrates storage offsite for centralized backup and recovery
- Fast application recovery with minimal or no transaction loss
- Creates disaster-tolerant copies of “bet your business” data

Qualifying questions

- Do you have unused storage capacity in your SAN that you would like to further utilize?
- Do you have Windows NT and UNIX servers for which you would like to share a central storage system?
- Are you looking for a low-cost alternative to a SAN solution that still allows you to grow into a SAN and leverage existing components?
- Do you have MSA1000s in your network environment?
- What steps are you taking to protect you and your customers from disaster?
- How are your branch offices handling data replication today?
- What steps are you taking to protect you and your customers from disaster?
- How are your branch offices handling data replication today?

When to Use NAS or SAN

NAS and SANs are complementary rather than competing technologies or products.

- NAS is an intelligent, file-aware server. Clients needing shared file system access need a scalable, available, and manageable NAS product regardless of whether the block level storage is connected to the NAS by a SCSI adapter on a PCI bus or by a Fibre Channel HBA on the PCA bus.
- A SAN is a dedicated network that provides an I/O channel between servers and storage. A SAN can include both block (SCSI) and file-oriented (NAS) products. NAS products can connect to storage devices over a SAN.

	NAS	SAN
Access	File level...CIFS, NFS, NCP	Block level (SCSI)
The network is...	The LAN	The SAN
Major applications	File serving to clients	Block serving to applications
Capacity	Terabytes	Petabytes
Management	Simplified storage management	Simplified storage management

Summary

Key enterprise NAS solutions include:

- HP StorageWorks NAS 4000s
- HP StorageWorks NAS 9000s
- Microsoft Volume Shadow Copy Service
- HP OpenView Storage Mirroring (optional)

Customer storage requirement	HP StorageWorks NAS solution
No single point of failure	NAS 9000s
Clustering for high availability	NAS 4000s, NAS 9000s
Non-disruptive backup	NAS 4000s, NAS 9000s
Replication over IP network	NAS 4000s, NAS 9000s
File and application serving in same environment	NAS 4000s, NAS 9000s
Improved performance with Windows Storage Server 2003	NAS 4000s, NAS 9000s

Learning check

1. Which of the following storage features has **not** been described in this module as a NAS feature?
 - a. Optimized file serving
 - b. NAS/SAN fusion
 - c. Vsnapshots
 - d. Snapshots
2. NAS 4000s snapshot capability enables instant creation of multipurpose virtual replicas of production data without requiring a physical copy the data.
 - ☐ True
 - ☐ False
3. NAS environments provide the user with information access at the _____ level.
 - a. File
 - b. Block
 - c. I/O channel
 - d. SCSI
4. Which of the following best describes HP OpenView Storage Mirroring?
 - a. Array-based data replication software that replicates data over Fibre Channel in either a synchronous or asynchronous mode.
 - b. Host-based application that performs remote replication over an IP LAN/WAN. Storage Mirroring runs on a WinTel server with Windows 2003/2000/NT operating systems.
 - c. Software that enables instant creation of multipurpose virtual replicas of production data without requiring a physical copy.
 - d. The ability to share a central storage system between Windows NT and UNIX servers.

5. _____ automatically takes dozens of point-in-time snapshots.
 - a. Virtual Replicator
 - b. Secure Path
 - c. Volume Copy Shadow Service
 - d. HP OpenView Storage Mirroring
6. Which of the following is **NOT** a NAS benefit?
 - a. Integration of file and block data
 - b. Unlimited scalability
 - c. Continuous data availability
 - d. Array-based file replication

Storage backup and archival systems

Module 12

Objectives

After completing this module, students should be able to:

- Identify tape backup and archival target customer profiles and their business needs.
- Describe the business value of HP StorageWorks tape backup and archival systems.
- Describe HP StorageWorks Enterprise Backup System components.
- Use appropriate questions to qualify opportunities in the tape backup and archiving target markets.

Overview

HP delivers the industry's most complete data protection and retention solutions for open systems and distributed environments through innovative products, integrated solutions, and breakthrough partnerships. This module describes hardware used for enterprise class storage backup and archiving.

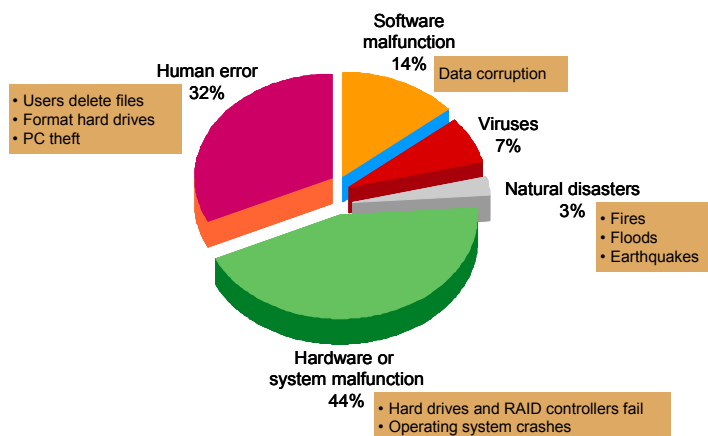
Key products and concepts

This module introduces the following products:

- Enterprise tape libraries
 - ESL E-Series Model 712e (LTO cartridge)
 - ESL E-Series Model 630e (SDLT cartridge)
 - HP StorageWorks ESL9322
 - HP StorageWorks ESL9595
- Mid-range tape libraries
 - HP StorageWorks MSL6060 and HP StorageWorks MSL6030
 - HP StorageWorks MSL5060 and MSL5030
 - HP StorageWorks MSL5052 and HP StorageWorks MSL5026
- Ultrium LTO tape drives
- SDLT tape drives
- HP StorageWorks Enterprise Backup Solution (EBS)
 - Network storage routers
- Library and tape tools
- HP Optical Jukebox family

Why protect data?

Customers may need a reminder about the importance of backing up their data.



Source: Understanding Data Loss. CBL Data Recovery Technologies Inc. Industry Sources – Data Recovery Report

Trends in the marketplace

Tape remains the cornerstone of nearly all customers' backup plans. Customers are not likely to rip out current tape infrastructures, but they are likely to implement disk-based backup solutions for select data with adoption taking place gradually. Most disk-based backup vendors promote the use of disk-based backup as staging to tape. Even with emergence of disk-based backup, tape continues to be the second line of defense behind disk-based backup. Reasons for a heightened sense of data protection include:

- Importance of disaster due to terrorist attacks
- Interoperability key concern of end users
- Government regulations for records retention such as Health Insurance Portability and Accountability Act (HIPAA) and Sarbanes-Oxley Act.

IPAA, enforceable as of April 2003, establishes guidelines for the transmission and retention of all health data and medical records.

Specifically, the rule requires all healthcare and related companies to keep records (for example, policies, patient requests, and complaints) for a minimum of six years.

Sarbanes-Oxley Act dictates how corporations must store financial data, as well as any data used to compute their financial status. It requires companies to store information in a format that cannot be changed.

- Rapid data growth
- Industry consolidation, driving heterogeneous environments in the data center
- Increasing cost of managing storage

Business needs for storage backup

There are several needs for storage backup in the enterprise class market, including:

- **Storage consolidation** — Customers improve utilization and reduce management overhead by automating more backup processes and sharing tape libraries on the network between servers.
- **Availability** — Data is becoming increasingly mission-critical, and systems need to be designed with hot-pluggable and hot-swappable components.
- **Investment protection** — As storage requirements grow, seamless expansion of tape libraries is required. As business conditions change, the ability to redeploy libraries adds flexibility to the data center.
- **Data protection and management** — Files or databases must be copied so that they are preserved in case of equipment failure or other catastrophe. The traditional backup infrastructure has included both backup applications and tape libraries. The backup applications manage and control both the backup process and the tape and tape automation hardware.
- **Manageability** — Hardware must be as easy to manage from the front panel as from across the country.
- **Compatibility** — All devices must work with the other software and hardware in the solution.
- **Preventive maintenance** — Customers want to avoid headaches, time, and money with tools and processes that prevent business interruptions.
- **Archiving** — Long-term backup and protection of data are needed.

Additional buying criteria

Additional buying criteria includes:

- Reliability of solutions
- Interoperability
- Performance
- Cost

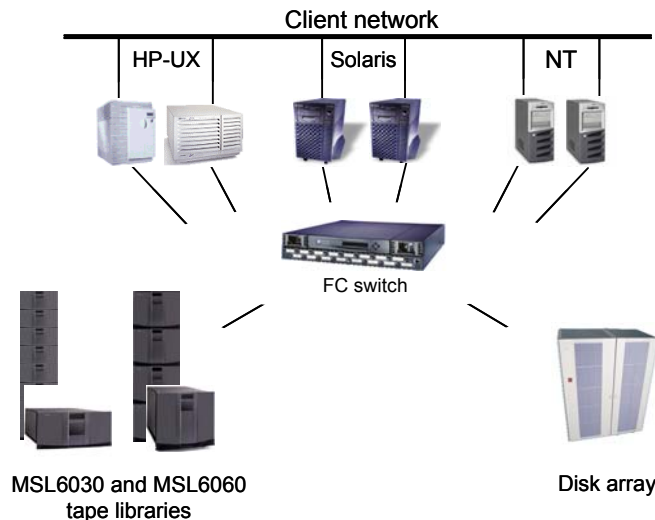
Customer business need: backup consolidation

Customer business issues that are addressed by consolidating storage backup resources include:

- Do more with less
- Provide improved data access
- Address high availability requirements
- Ensure security
- Meet service level agreements

SAN backup

SAN backup enables customers to maximize the benefits of their investments.



Customer benefits of storage backup consolidation

Customers can protect their storage investments and leverage the SAN benefits:

- Improved utilization rates
- Lower cost per GB in compact footprint
- Shared library between all servers for increased operational efficiency
- Increased scalability by merging disk and tape on the same SAN

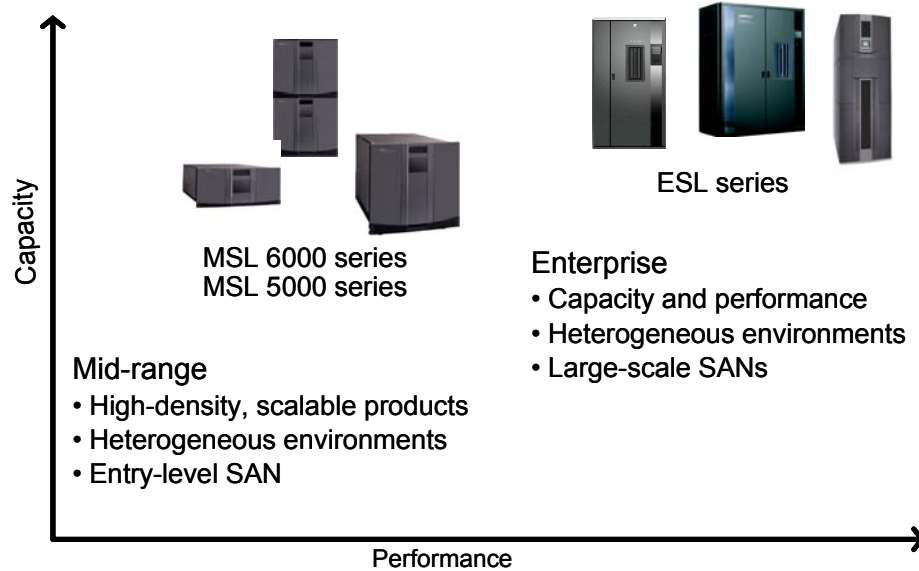
Selling value — qualifying questions

The following questions may be helpful in articulating the customer benefits of storage consolidation and SAN backup.

- Are you having performance problems attributed to backup?
- Do you have underutilized storage capacity in your data centers?
- Are you managing disparate storage pockets throughout your data centers?
- Are your backup systems all over the place and taking up valuable floor space?

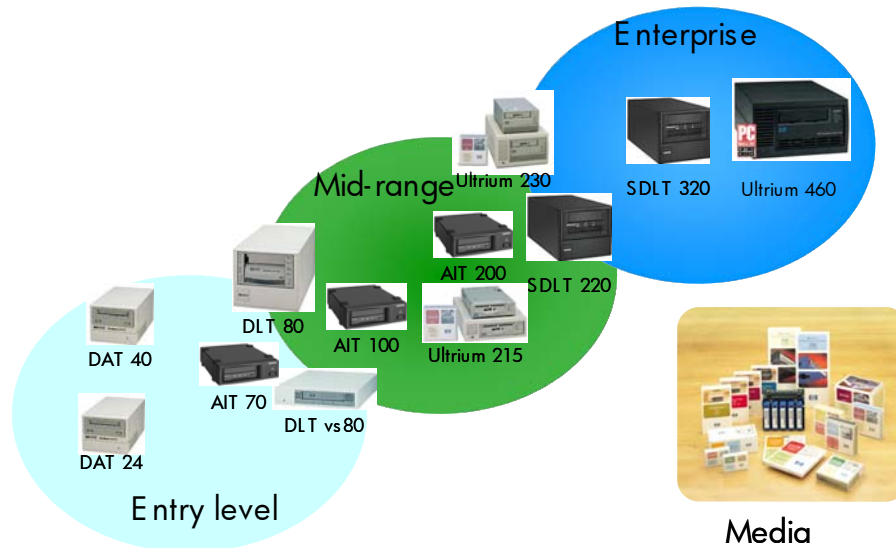
HP StorageWorks tape libraries

HP tape libraries provide data protection for a variety of HP and third-party software platforms using a variety of tape drive technologies.



HP StorageWorks tape drive family

HP supports an industry-leading selection of tape drives.



Enterprise tape drives

HP StorageWorks enterprise backup solutions usually include one of two tape drives:

- **Linear tape open (LTO)** — When backup time is critical, HP Ultrium is the clear choice of tape technologies in enterprise environments. HP continues to dominate the LTO market, with 46.7% of Ultrium drive shipments. Customers are choosing Ultrium for its performance and industry-standard format.
- **Super digital linear tape (SDLT)** — For customers who have standardized on DLT/SDLT technology, HP continues to offer SDLT.

Note

Expanded LTO Ultrium drive support is an industry initiative created by HP, IBM, and Seagate that provides an open tape drive format choice for customers. Ultrium is the LTO format for backup and restore applications. All Ultrium media products that display an LTO logo are interchangeable with drives from any licensed Ultrium manufacturer.

LTO Ultrium drives are well suited for customers who:

- Have a network backup environment or tape automation, especially in a SAN
 - Prefer the benefits of an open standard
 - Have heterogeneous system environments with HP and third-party servers, operating systems, and backup software
-

HP StorageWorks backup solutions also include other types of tape drives that are described in the course *Selling HP Business Class Storage Solutions*:

- Advanced intelligent tape (AIT)
- Digital data storage/digital audio tape (DDS/DAT)

ESL tape library market

The market for the ESL tape library family includes the following:

- **Segments**
 - Backup and restore applications for large enterprise database servers
 - Mission-critical consolidated databases (e-commerce, telecom, finance, insurance, medical, research, data center, service providers)
 - Support for heterogeneous environments

- **Segment profile**
 - Larger companies with thousands to tens of thousands of employees
 - Exponential data growth of greater than 50% annually
 - Backing up no less than 1TB of data nightly
 - Mission-critical, 24x7 operations
 - Large, multi-operating system SAN environments
 - Expectation of 3- to 5-year life of tape library
 - Not as price sensitive as the smaller companies
 - Rapidly shrinking backup window, if any at all
 - Select tape drives based on performance/capacity/longevity
 - Want high performing, highly reliable systems
 - Willing to pay for performance and availability
- **Target audience**
 - Target audience is CIO, data center managers, IS managers
 - End users and operators are decision influencers
- **Target industries** — There are essentially three target enterprise segments for the ESL family of libraries:
 - **Solution seekers** — This segment wants a full solution from a single vendor and has the lowest price sensitivity of the target segments. Solution seekers are typically larger companies, averaging over \$500 million in revenue.
 - **Big spend/small resource** — This segment is intensely focused on disaster recovery, has concerns over reliability, and is concerned with resources, spending large amounts of time on backup and recovery rather than other “more strategic” work.
 - **Informed and cost conscious** — This segment is typically large companies, generally located within one geography. These types of companies are informed professionals who have been in the business for a long time and are the most willing to build their own solutions. They do not want to pay for something they will not use.

ESL E-Series tape library family

The HP StorageWorks Enterprise Library portfolio is expanding to include the ESL E-Series enterprise tape library. This library, coupled with HP Extended Tape Library Architecture (ETLA), offers self-aware storage designed specifically for the SAN.

The StorageWorks E-Series offers best-in-class drive and cartridge density. E-Series cartridge capacity scales to 712 LTO or 630 SDLT cartridges and 24 drives in a single library frame. Available with either Ultrium 460 or SDLT 320 tape technology, the E-Series offers storage density with 14.2TB of storage capacity per square foot.

ESL E-Series tape libraries and ETLA offer customers with enterprise storage area networks superior reliability, interoperability, and advanced functionality. ETLA also offers remote management of the entire library system from a single pane of glass including complete, unobtrusive management and control of the entire library system including robotics, drives, interface controllers, and interface manager card.

To ensure compatibility in current environments, the ESL E-Series tape libraries are fully certified in the Enterprise Backup Solution (EBS) program.



The E-Series platform advantages

The E-Series platform offers some advantages over the ESL platform.

- Native FC tape drives accommodate advanced features such as data path failover inside the library and increased levels of virtualization using disk and tape combinations within the library
- Tape technologies beyond SDLT600 and LTO3
- Higher scalability up to 116 drives and 3050 slots
- Specific new features such as performance optimization, tape mirroring, sidecar and web-cam support
- Higher capacity load ports

Additional features will be available later in 2004:

- The ability to start low and scale high with a wider range of slot licensing options using the 214e and 190e models
- Native Fibre Channel (NFC) Ultrium Drives (Customers can put the NFC drives into the ESL E-Series, when they are available.)
- Removable magazines (upgrades available mid-2004)
- Multi-unit scalability (available in Fall 2004)
- Mixed media (available in Fall 2004)

Comparison to ESL9000 models

The ESL E-Series libraries are not a replacement for the existing ESL libraries.

- Most of the features available on the E-Series are also available on the ESL.
- Drive upgrades and ongoing interoperability testing will continue on both platforms.

	ESL9322	ESL9595	ESL 630e	ESL 712e
Cartridge count	222, 322	400, 500, 595	630	712
Drive technology	Ultrium 230/460 SDLT 220/320	Ultrium 230/460 SDLT 220/320	SDLT 320	Ultrium 460
Drive count	1–8	1–16	1–24	1–24
Maximum native capacity (LTO 460/SDLT 320)	64TB/51.5TB	119TB/95.2TB	100.8TB	142.4TB
TB square foot	7.95/6.39	9.8/7.9	14.2/10	14.2/10

Platform positioning

ESL E-Series is the right solution when the customer requires:

- 595+ cartridge slots
- High storage and drive density
- Native Fibre tape drives
- Removable magazines and bulk loading/unloading
- Path failover capabilities (will be done in conjunction with native fibre tape drives)
- Higher capacity load ports

ESL9000 series is the right solution when the customer wants:

- Only a few hundred cartridge slots (200–595)
- Expansion of currently installed ESL9000s by using a pass-through mechanism
- SDLT 220 or Ultrium 230 technology
- All ETLA components bundled together into one SKU: ESL extended libraries
- Mixed drive capability

ESL E-Series support

The E-Series tape libraries are supported on the following ISVs:

- HP OpenView Storage Data Protector
- Veritas NetBackup
- Legato Networker
- Tivoli Storage Manager
- CA ARCserv 2000
- Veritas Backup Exec

The E-Series tape libraries support the following operating systems:

- HP-UX
- Windows2003
- Windows
- Solaris
- AIX
- Linux
- NetWare
- Tru64 UNIX
- OpenVMS

ESL9000 Series tape library family

The HP StorageWorks ESL9000 Series tape libraries provide a highly reliable backup and restore solution for mission-critical data storage requirements of high-end enterprise customers. The ESL9000 Series tape libraries provide component-level redundancy, high availability, and enterprise level capacity in a compact footprint for direct SCSI and SAN environments. The ESL9000 Series tape libraries provide years of fully automated operation for backup, save, and restore of critical data when coupled with a variety of qualified industry-standard backup application solutions.

These libraries handle the toughest storage situations by offering the following unique features:

- Media partitioning that supports LTO Ultrium and SDLT drives simultaneously. Mixed drive capability is supported through media partitioning and is based on ISV software. Essentially, the library is divided into smaller virtual libraries, as seen by the ISV software.
- Ultra3 embedded routers—a true 2x4 FC interface controller. With the next generation of Ultrium technology, configuring one drive per SCSI bus will ensure that customers are able to receive the maximum benefit of the tape drive.
- Highest density available
- Best robotics reliability at 2 million cycles MTBF
- Hot-swappable components
- Easy-to-use graphical user interface
- Optimized library performance with HP branded tape media that performs beyond industry standards

ESL9322

The ESL9322 offers extreme configuration flexibility with 222 or 322 slots and up to eight hot-plug drives of the following technologies:

- LTO Ultrium 460
- LTO Ultrium 230
- SDLT 320
- SDLT 230 tape drives

Using LTO Ultrium 460 tape drives, the ESL9322 provides up to 64.4TB native capacity and 864GB/hr native backup performance. This library also allows users to:

- Use a pass-through mechanism to connect up to five libraries for 337.6TB native capacity and 4.32TB/hr native backup performance
- Mix LTO Ultrium 460, LTO Ultrium 230, SDLT 320, and SDLT 220 in the same library using media partitioning

The ESL9322 tape library is also qualified for direct SCSI attach and EBS FC SAN configuration.



ESL9322 model comparison

ESL9322 SDLT 320	ESL9322 LTO Ultrium 230	ESL9322 LTO Ultrium 460
222, 322 slots	222, 322 slots	222, 322 slots
51.52TB native capacity single unit	32.2TB native capacity single unit	64.4TB native capacity single unit
Up to 460.8GB/hr native backup performance	Up to 432GB/hr native backup performance	Up to 864GB/hr native backup performance
16MB/s native drive throughput	15MB/s native drive throughput	30MB/s native drive throughput
Multi-unit expansion up to 235.84TB native capacity up to 2.3TB/hr native backup performance	Multi-unit expansion up to 146.8TB native capacity up to 2.16TB/hr native backup performance	Multi-unit expansion up to 337.6TB native capacity up to 4.32TB/hr native backup performance

ESL9595

The ESL9595 is designed for enterprise customers who need a highly reliable backup and restore solution. This innovative tape library offers 400, 500, or 595 slots and up to 16 hot-plug drives. For configuration flexibility, the ESL9595 tape library supports

- HP StorageWorks SDLT 110/220, 160/320
- LTO Ultrium 230 and LTO Ultrium 460 drives

Using LTO Ultrium 460 tape drives, the ESL9595 provides up to 119TB native capacity and 1.728GB/hr native backup performance. This library also allows users to:

- Use a pass-through mechanism to connect up to four libraries for 455.6TB native capacity and 6.91TB/hr native backup performance
- Mix LTO Ultrium 460, LTO 230, SDLT 320 and SDLT 220 tape drives

The ESL9595 tape library is also qualified for direct SCSI attach and EBS FC SAN configuration.



ESL9595 model comparison

ESL9595 SDLT 320	ESL9595 LTO Ultrium 230	ESL9595 LTO Ultrium 460
400, 500, 595 slots	400, 500, 595 slots	400, 500, 595 slots
95.2TB native capacity single unit	59.5TB native capacity single unit	119.0TB native capacity single unit
Up to 921.6GB/hr native backup performance	Up to 864GB/hr native backup performance	Up to 1728GB/hr native backup performance
16MB/s native drive throughput	15MB/s native drive throughput	30MB/s native drive throughput
Multi-unit expansion up to 364.48TB native capacity up to 3.46TB/hr native backup performance	Multi-unit expansion up to 227.8TB native capacity up to 3.45TB/hr native backup performance	Multi-unit expansion up to 455.6TB native capacity up to 6.91TB/hr native backup performance

e2400-160 Interface Controller

The HP StorageWorks Interface Controller is a key component in a complete data protection solution. It is an embedded Fibre Channel-to-SCSI controller with two user-configurable 1Gb or 2Gb Fibre Channel ports and four SCSI (LVD) ports. It allows multiple host servers to communicate with a SCSI tape device over a Fibre Channel link.

The HP StorageWorks Interface Controller is targeted toward customers whose backup window is impacting mission critical business operations and who need to reduce or remove the impact of the backup window. Characteristics include:

- Similar architecture to disk-arrays with controllers in front of disk drives
- Layer of intelligence between tape drives and the SAN
- Manages shared access to the tape library, intelligently handling conflicts, and storage network events

Controllers provide the highest possible investment protection by enabling the customer to upgrade to future interface technologies without having to replace back-end tape drive technology.

ESL9000 operating system, ISV and server support

ESL9000 libraries support the following operating systems and data protection software.

Operating system	ISV
HP-UX	HP OpenView Storage Data Protector
AIX	HP Omniback
Linux	CA Brightstor
NetWare	Legato Networker
OpenVMS	Tivoli Storage Manager
Tru64 UNIX	Veritas NetBackup
Solaris	Veritas Backup Exec
Windows	

ISV and server support for ESL9000 libraries include the following:

ProLiant	HP-UX	HP-Intel
ProLiant DL760	Superdome	HP LXR8500
ProLiant ML750	RP8400	HP LH6000
ProLiant DL580 G2	RP7400 (N class)	HP LH6000R
ProLiant ML 570	RP5400 series (L class)	HP LT6000R
ProLiant ML530 G2	RP2450/2470 (A class)	HP TC4100
ProLiant DL380 G2	K class	HP TC3100
ProLiant ML370 G2	D Class	HP LH3000
ProLiant ML350		HP LC2000R
ProLiant ML330 G2		HP LP2000R
		HP LP1000R
		HP E200
		HP E800

MSL6000 tape library family

The HP StorageWorks MSL6000 Ultrium tape library family provides performance and investment protection. Designed to maximize the performance of the Ultrium 460 drive, the MSL6000 also provides unparalleled flexibility. The MSL6000 can be scaled with other MSL libraries using a pass-through mechanism for up to 16 drives and 240 slots, allowing a single library to grow and change with capacity and technology needs. In addition, the MSL6000 libraries are easily managed through an intuitive GUI control panel and integrated remote Web management.

MSL6000 family comparison

MSL6030	MSL6060
LTO Ultrium 460 drives	LTO Ultrium 460 drives
5U	10U
30 slots	60 slots
Supports up to 2 drives	Supports up to 4 drives
6TB maximum storage capacity	12TB maximum storage capacity
Up to 108GB/hr native backup performance	Up to 216GB/hr native backup performance

MSL6000 features

- **High-performance** — SCSI Ultra 3 maximizes the throughput of Ultrium 460 tape drives.
- **Multi-unit modular scalability** — Any combination of MSL6030 and 6060s up to 40U high can be used.
- **Manageable** — User-friendly GUI control panel and web interface make library management easy.
- **Flexible** — Using cPCI slots, the MSL library can be configured to either Fibre Channel or LVDS.
- **Reliable** — Tape libraries provide consistent backup and automatically change tapes.
- **Affordable** — Customers buy only the storage they need now and add more later.
- **Compatible** — MSL libraries work with industry-leading servers, operating systems, and backup software.

MSL6000 and MSL5000 differences

The main differences between the MSL6000 family and the MSL5000 family are:

- **Increased performance** — SCSI Ultra3 library takes advantage of the full performance available from the Ultrium 460 tape drive.
- **Auto-power-on** — Allows users to select whether the library will automatically reboot in the event of a power failure.

MSL library market

The market for the MSL tape library family includes the following:

- **Segments**
 - Backup and restore applications for large enterprise database servers
 - Mission-critical consolidated databases (e-commerce, telecom, finance, insurance, medical, research, data center, service providers)
- **Segment profile**
 - Large businesses with more than 500 employees and multiple locations
 - Database applications operating on enterprise class servers
 - Requirement for frequent full backups at a single consolidated site instead of at each individual server location
 - Typical annual data growth rates of 50% to 100% or more
- **Target customers**
 - Target audience is CIO, data center manager, IS manager
 - End users and operators are decision influencers

Why is Ultra3 SCSI important?

The Ultrium 460 tape drive is the highest performance tape drive installed in the MSL library. With a transfer rate of up to 60MB/s (2:1 compression), the Ultrium 460 tape drive needs a SCSI bus that can supply data at high speeds.

- Ultra 3 SCSI supports burst speeds of up to 160MB/s (sustained speeds of 96–120MB/s).
- Ultra 2 SCSI maximum available speed is 48–60MB/s, which is not enough to guarantee performance.

MSL5000 tape library family

HP StorageWorks MSL5000 tape libraries provide an innovative answer to backup and restore requirements of customers in the mid-range and departmental segments. Designed for flexibility, the MSL5000 tape library can be scaled with another MSL5000 library using a pass-through mechanism that allows a single library to grow in response to capacity needs. In addition, the MSL5000 libraries are easily managed through a user-friendly GUI control panel and integrated remote Web management.



MSL5000 features

Available with LTO Ultrium 230 and SDLT drives, the MSL tape library family includes:

- **MSL5026DLX** — comes in a 5U form factor and supports up to two drives and 26 SDLT 40/80 cartridges per module, for a maximum of 1.04TB of native capacity and a transfer rate of 43.2GB/hr (scales out to seven modules)
- **MSL5026S2 (SDLT)** — comes in a 5U form factor and supports up to two drives and 26 SDLT 160/320 cartridges per module, for a maximum of 4.16TB of native capacity and a transfer rate of 230.4GB/hr (scales out to eight modules)
- **MSL5026SL** — comes in a 5U form factor and supports up to two drives and 26 SDLT 110/220 cartridges per module, for a maximum of 2.86TB of native capacity and a transfer rate of 79.2GB/hr (scales out to seven modules)
- **MSL5030L1 (LTO)** — comes in a 5U form factor and supports up to two drives and 30 Ultrium 230 cartridges per module, for a maximum of 3.0TB of native capacity and a transfer rate of 108.0GB/hr (scales out to eight modules)
- **MSL5052S2 (SDLT)** — comes in a 10U form factor and supports up to four drives and 52 SDLT 160/320 cartridges per module, for a maximum of 8.32TB of native capacity and a transfer rate of 230.4GB/hr (scales out to four modules)
- **MSL5052SL** — comes in a 10U form factor and supports up to four drives and 52 SDLT 110/220 cartridges per module, for a maximum of 5.72TB of native capacity and a transfer rate of 158.4GB/hr (scales out to four modules)
- **MSL5060L1 (LTO)** — comes in a 10U form factor and supports up to four drives and 60 Ultrium 230 cartridges per module, for a maximum of 6TB of native capacity and a transfer rate of 216GB/hr (scales out to four modules)

MSL5000 comparison

The MSL5000 systems are supported on a variety of operating systems: Windows 4.0, Windows NT and Windows 2000, HP-UX, Tru64 UNIX, NetWare, Solaris, Linux, AIX, and SUSE.

MSL5026SL	MSL5030L1	MSL5026S2	MSL5052SL	MSL5060L1	MSL5052
SDLT 220	LTO Ultrium 230	SDLT 320	SDLT 220	LTO Ultrium 230	SDLT 320
5U	5U	5U	10U	10U	10U
26 slots	30 slots	26 slots	52 slots	60 slots	52 slots
2.86TB native capacity	3.0TB native capacity	4.16TB native capacity	5.72TB native capacity	6.0TB native capacity	8.32TB native capacity
Up to 79.2GB/hr native backup performance	Up to 108GB/hr native backup performance	Up to 115.2GB/hr native backup performance	Up to 158.4GB/hr native backup performance	Up to 216GB/hr native backup performance	Up to 230.4GB/hr native backup performance
572GB/U density	600GB/U density	832GB/U density	572GB/U density	600GB/U density	832GB/U density

MSL Ultrium library server support

The HP StorageWorks Ultrium tape drives are supported on the following classes of HP systems

ProLiant	HP-UX	HP-Intel
HP ProLiant DL servers	Superdome	HP LXR8500
HP ProLiant ML servers	RP8400	HP LH6000
HP9000 servers	RP7400 (N class)	HP LH6000R
HP RX and RP series servers	RP5400 series (L class)	HP LT6000R
HP TC series servers	RP2450/2470 (A class)	HP TC4100
HP workstations	K class	HP TC3100
	D class	HP LH3000
		HP LC2000R
		HP LP2000R
		HP LP1000R
		HP E200
		HP E800

HP StorageWorks Ultrium 460 tape drive for ProLiant

The HP StorageWorks Ultrium 460 tape drive for ProLiant is the second generation of the HP Ultrium tape drive family. It delivers a capacity of 400GB (2:1 compressed) on a single HP Ultrium cartridge. Reinforcing the HP leadership position in tape, the Ultrium 460 builds on the success of the Ultrium 230 and provides unprecedented levels of performance, capacity, and reliability. It also sets new standards in the superdrive tape market. The Ultrium 460 is the ideal choice for modern data centers where the backup window is shrinking.



Features

- Large backup capacity of 200GB (native) or 400GB (compressed 2:1)
- Among the fastest performing tape drives in the industry today:
 - Provides a data transfer rate of 30MB/s (native) or 60MB/s
 - Translates into a backup performance of up to 108GB/hr (native) or 216GB/hr (compressed 2:1)
- Lowest cost of ownership: HP Ultrium 2 media costs about 70¢/GB, compared to 80¢/GB for SDLT 160/320 and \$1.80/GB for DLT 40/80
- Universal implementation into ProLiant servers
- Adaptive tape speed dynamically matches the transfer rates of slower hosts (from 10MB/s upwards), increasing performance, reducing mechanical wear, and extending tape life. This is a key differentiator between LTO and SDLT. Ultrium drives negotiate constantly during writes to tape, whereas SDLT/DLT *shoeshines* while waiting, wearing down the media.
- Active head cleaning provides an automated cleaning solution, which increases the head life and reduces the need for periodic cleaning.
- Supported with Veritas Backup Exec 8.6, Computer Associates BrightStor ARCserve 2000, and HP OpenView Storage Data Protector V5.0 and 5.1. It is also qualified on Microsoft Windows NT V4.0 and Windows 2000.
- Ultrium formats are open standards. Data written on any HP StorageWorks Ultrium 460 tape drive for ProLiant systems can be interchanged directly with Ultrium 2 tape drives from other vendors.

HP StorageWorks Ultrium 230 tape drive for ProLiant

The HP StorageWorks Ultrium 230 tape drive for ProLiant offers excellent capacity, superior performance, and exceptional reliability. With ease-of-use in mind, the rugged design builds on the best existing technologies and adds advanced features to create a new level of data protection.

With the ability to store over 100GB native capacity on a single tape and with a backup rate of 54GB/hr, the Ultrium 230 tape drive for ProLiant is an ideal solution for network backup where speed and reliability are critical.

Features

- Provides large backup capacity of 100GB (native) or 200GB (compressed 2:1).
- Among the fastest performing tape drives in the industry today:
 - Provides a data transfer rate of 15MB/s (native) or 30MB/s
 - Translates into a backup performance of up to 54GB/hr (native) or 108GB/hr (compressed 2:1)
- Data rate matching technology:
 - Allows the drive to be used on slower hosts at optimum performance by being able to accept a variable data rate of between 6MB/s and 15MB/s
 - Reduces drive and media wear, which improves reliability
- Universal implementation into ProLiant servers from HP
- Cartridge memory helps to improve media management, and reduces the beginning of tape media wear by recording key information in a flash memory device inside the media cartridge
- Supports disaster recovery for easy restore from a hard drive failure (when used with appropriate backup software)

Ultrium tape drive specifications

	HP Ultrium 460	HP Ultrium 230	HP Ultrium 215
Ultrium format	Ultrium 2	Ultrium 1	Ultrium 1
Native capacity	200GB	100GB	100GB
Compressed capacity*	400GB	200GB	200GB
Native transfer rate	30MB/s	15MB/s	7.5MB/s
Compressed transfer rate	60MB/s	30MB/s	15MB/s
ATS range	10–30MB/s	6–15MB/s	6–7.5MB/s
Form factor	Full height	Full height	Half height
Disaster recovery	OBDR	OBDR	OBDR
Read/write compatibility	Ultrium 2/Ultrium 1	Ultrium 1	Ultrium 1
Data compression	ALDC	ALDC	ALDC
Interface	Ultra-3 SCSI	Ultra-2 SCSI	Ultra-2 SCSI

HP StorageWorks SDLT 320GB tape drive

The SDLT 320 is an enhanced version of the SDLT 110/220 tape drive. It offers a 45% increase in native capacity per cartridge (160GB) and data transfer performance (16MB/s). The SDLT 320 offers the same backward-read compatibility to current DLT tape drives as the SDLT 110/220. It is also write-compatible with the SDLT 110/220 and uses the same SDLT1 media and cleaning cartridge.

Key features

- 160GB of native storage capacity increases the amount of storage available on each data cartridge.
- 16MB/s native performance decreases the customer's backup window.
- Standard Ultra II LVD SCSI interface provides compatibility with the leading HP server and storage products.
- Backward-read compatibility with DLT and SDLT drive formats provides investment protection for customers who have an installed base of DLT and SDLT data protection solutions.
- HP-UX is supported on MSL and ESL libraries with SDLT 220 and 320 drives using Data Protector, Legato NetWorker, or Veritas NetBackup.

Positioning Ultrium and SDLT tape libraries

If the customer has a preference for DLT or SDLT, close the sale with DLT or SDLT. However, if the customer does not have a preference, always lead the sales discussion with Ultrium.

Sell MSL family Ultrium libraries to customers who:

- Need Ultrium drive technology
- Require HP-UX compatibility
- Require HP-SureStore SAN compatibility
- Require XP disk array compatibility
- Require AIX, Solaris connectivity

Sell MSL family SDLT libraries to customers who

- Need SDLT or DLT compatibility
- Operate heterogeneous operating system environments including Tru64 UNIX connectivity

HP disaster recovery solutions

HP One-Button Disaster Recovery (OBDR) and HP StorageWorks DRTape disaster recovery solution are equivalent solutions that provide the most convenient approach to system disaster recovery by using direct attach tape.

- No additional media, such as CD-ROM or floppy diskettes, are required.
- OBDR and DRTape are available for all HP customers.
- On-platform customers (HP ProLiant) get the highest possible level of testing and the potential for other value-added features.
- Off-platform customers can make use of the feature by using a host bus adapter (HBA) to connect.

One-Button Disaster Recovery

With HP One-Button Disaster Recovery (OBDR), customers can automatically save their latest configuration every time they make a standard backup tape. The financial implications of a disaster increase every minute the process is delayed. HP OBDR is built into the entire family of HP DAT drives, HP DLT VS, and HP Ultrium-format tape drives.

When a computer crash does occur, the first and biggest problem is rebuilding and reconfiguring the system. Although the rest of the organization may be clamoring to get back to work, no documents can be recovered until the system is restored.

Key features of OBDR include:

- The ability to quickly, reliably, and simply restore an entire system just by inserting the most recent backup tape and pushing one button on the tape drive. The HP DAT, DLT VS, or Ultrium drive will restore the operating system, configuration, applications, drivers, and data files.
- It is no longer necessary to make a new set of disaster-recovery floppy diskettes each time the network configuration is altered or a peripheral such as a printer is added.
- The sheer simplicity of HP OBDR means that the risk of a user error during recovery, and therefore subsequent recovery failure, is significantly reduced.
- Backup and disaster recovery preparation—previously two separate tasks—become one and the same process.

HP StorageWorks DRTape disaster recovery solution

DRTape from HP is a firmware-driven software utility that provides a disaster-recovery solution for HP ProLiant servers. Using HP branded DAT, AIT, DLT, and SDLT tape devices, DRTape can restore a server's operating system, software applications, and data using one tape cartridge. Depending on the size of the data set, DRTape may be able to restore system software and data in less than an hour.

Key features include:

- DRTape is a value-added software utility embedded in the firmware of supported HP tape devices.
- When activated, the DRTape firmware utility identifies the HP tape drive or autoloader as a bootable SCSI device and allows the ProLiant server to restore its operating system, application software, and data from a designated DRTape backup cartridge.
- To activate DRTape, all that is required is the DRTape-Ready HP tape drive, a designated DRTape backup tape cartridge, and the HP SmartStart CD to recover the system. No further CDs or media are required to restore the system.
- HP customers can acquire the DRTape firmware utility by downloading current firmware upgrades for supported tape devices through the HP website or by purchasing DRTape-ready tape devices.
- The DRTape disaster recovery utility is embedded in the tape drive firmware and is supported by Veritas Backup Exec, CA ARCserve 2000, HP Data Protector, and Yosemite TapeWare. In combination with SmartStart, only a designated bootable DRTape cartridge is needed to restore the server.
- DRTape completely restores all software and data from one bootable tape cartridge. This feature provides a simpler, lower-cost solution for managing a disaster recovery strategy.
- DRTape is supported by a wide variety of HP tape devices, ProLiant servers, and SCSI host bus adapters. HP customers can implement DRTape with industry-leading server and data protection products.

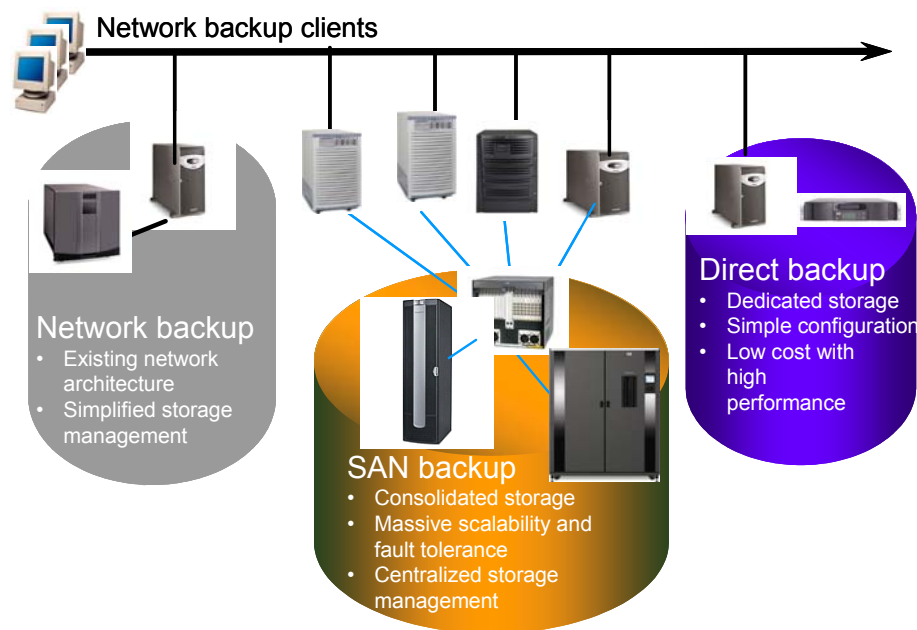
Customer business need: data protection and management

Look for customers who have:

- Users complaining of backed up traffic on the network
- Backup windows that are shrinking
- A storage environment that is no longer cost-effective and is draining IT budgets
- A critical requirement to consolidate primary and secondary storage
- Investment in multiple dedicated tape drives, which is costly and time-consuming to manage

Solution: Enterprise Backup Solution (EBS)

The HP StorageWorks Enterprise Backup Solution (EBS) is a data protection solution for customers looking to consolidate their data protection schemes across multi-vendor platforms and heterogeneous operating systems. EBS provides a unique solution to the backup dilemma by providing fully certified and supported configurations, scaling from entry-level workgroups to enterprise-level data centers capable of backing up multiple terabytes of information.



EBS highlights

HP provides backup and recovery solutions to back up virtually any type of data through a wide range of backup methods (including direct, network, and SAN backup). EBS is an end-to-end data protection solution for networked storage environments that provides:

- Support for the latest tape products and technologies
- Certified interoperability for third-party platforms and storage devices
- Support for LTO Ultrium, Super DLT, DLT and AIT tape automation in DAS and SAN environments
- Heterogeneous operating system support in SAN configurations
- Support for multiple operating systems, including HP-UX, Windows 2003, Windows 2000, Tru64 UNIX, OpenVMS, Linux, NetWare, Solaris, and AIX
- Serverless backup solution for MSA1000, EVA and MA/EMA arraysCompatibility matrix to simplify configuration and deployment
- Supports media partitioning in the tape libraries

EBS market segments

HP understands that customers have a variety of product and solution needs based on price, performance, total cost of ownership, lower management costs, future scalability, and investment protection. To that end, HP has segmented EBS to fit two market segments:

- Low-cost, entry-level SANs
- High-performance SANs in heterogeneous environments

The StorageWorks EBS family segmentation helps provide customers with a quick understanding of which EBS solution is right for their needs. Solutions are designed and developed with industry-leading independent software vendors (ISVs). HP leverages partners with expertise in specific application areas to deliver optimized integration.

EBS applications support for HP high-performance SANs in heterogeneous environments includes support for the following backup software:

Requirement	Backup software
HP OpenView Storage Data Protector for customers who want a complete end-to-end data protection solution	HP OpenView Storage Data Protector (see Module 15)
Certified tier 1 ISV backup applications for customers who have already standardized on a third-party application	<ul style="list-style-type: none"> ■ CA BrightStor ARCserve ■ Tivoli Storage Manager ■ Legato NetWorker ■ Veritas Backup Exec ■ Veritas NetBackup
Self-certified tier 2 ISV backup applications	<ul style="list-style-type: none"> ■ CommVault Galaxy ■ Atempo Time Navigator ■ BackBone NetVault ■ SyncSort Backup Express

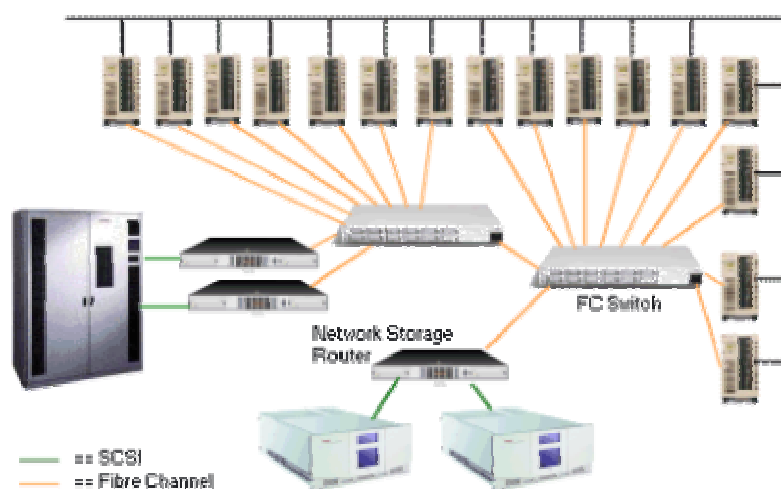
HP OpenView Storage Data Protector is certified in StorageWorks EBS (SAN) and direct attached environments.

Network storage routers

HP StorageWorks network storage routers are key components in a complete data protection SAN solution. Network storage routers are SCSI-to-Fibre Channel bridges that connect SCSI tape libraries to a SAN.

Network storage routers are targeted for customers whose backup window is impacting mission-critical business operations and who can benefit by the efficiency of passing data directly from disk to tape. Routers offer support for serverless backup, 1Gb/s and 2Gb/s Fibre Channel, and have web-based management allowing for remote management.

Serverless backup is accomplished with intelligent network storage routers. A snapshot is taken of the data, and then the snapshot is backed up, eliminating the backup window. Serverless backup frees the backup server to perform other operations and eliminates the flow of backup data through the server memory.



Storage routers and interface controllers:

- Provide a connection point for tape libraries
- Routers can be external or embedded
- Provide all qualities of a data mover embedded within the router firmware
- Provide segmentation of data transported in a SAN
- Do not have to be SCSI-connected to the serverless backup target devices
- High SAN availability since management traffic stays out of the data path

If you have the following tape library...	Then use...
MSL5000 series (Ultra2)	NSR e1200
MSL6000 series (Ultra3)	NSR e1200-160
ESL9000 series (Ultra2)	NSR e2400
ESL9000 series (Ultra3)	e2400-160 FC interface controller
ESL E-Series (Ultra3)	e2400-160 FC interface controller

Router and serverless backup support

Serverless backup supported options include:

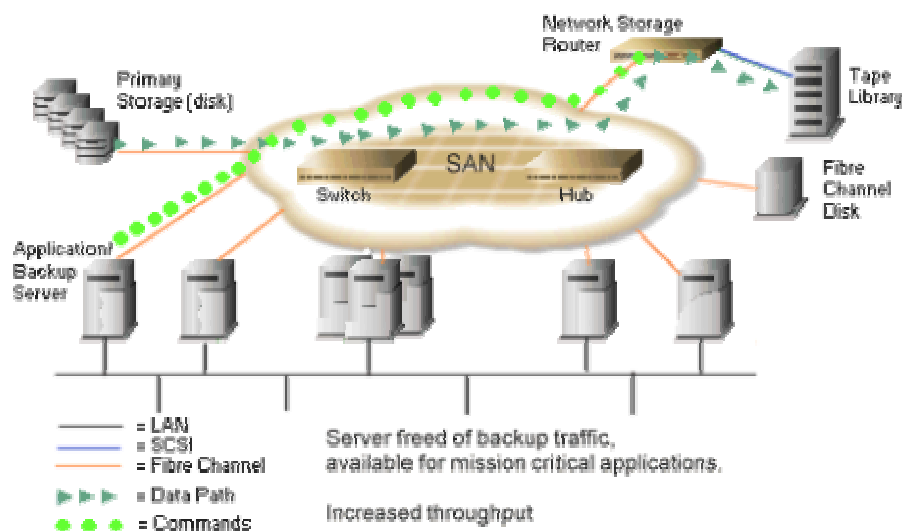
- VERITAS NetBackup ServerFree Agent
- VERITAS Backup Exec
- Computer Associates BrightStor ARCserve Serverless Backup Option with ARCserve Image Option
- Computer Associates BrightStor Enterprise Backup Serverless Backup Option with BEB Image Option

How serverless backup works

Serverless (server-free) backup describes the moving of the I/O overhead associated with backing up data away from the server to an intelligent device—a network storage router (NSR) on the SAN. A network storage router takes over managing the movement of data from one storage device to another and is responsible for reporting the progress and completion of this activity to the backup server when finished.

The NSR implements ANSI-standard SCSI-3 extended copy functionality to increase overall system performance. By allowing the server to offload data movement to the NSR, the third-party copy option frees up valuable CPU and memory resources on the server to provide full availability to mission-critical applications. The backup window is reduced because the server is removed from the data path. The amount of time needed to perform a backup is reduced. When implemented with snapshot software, the backup window is eliminated.

The following graphic shows the data path from primary storage (disk) to the network storage router to the tape library. The backup **commands** begin at the application/backup server, and proceed to the network storage router and tape library. Data does not pass through the application/backup server.



Serverless backup options from the ISVs (Veritas, CA) implement serverless backup with snapshot software that quiesces the application, takes a snapshot, restarts the database, and then initiates the serverless backup using the snapshot.

If you have the following tape library...	And you want serverless backup then use...
MSL5000 series	<ul style="list-style-type: none"> ■ NSR m2402 ■ NSR N1200 ■ NSR e1200
MSL6000 series	e1200-160
ESL9000 series	<ul style="list-style-type: none"> ■ NSR m2402 ■ NSR N1200 ■ NSR e2400 ■ e2400-160
ESL E-Series series	e2400-160

Extended copy

Third-party copy is a SNIA standard, and extended copy is a proposed ANSI-standard SCSI-3 command that allows specialized SAN-interconnect devices (such as storage routers) to perform movements of “block” data from a source to a target. Because the “data-mover” device only knows about data blocks (and does not have any understanding of files, databases, or file systems), the data mover is not useful without applications software to formulate programming instructions (commands and metadata) to control the operation of the data mover. Both firmware in the router and backup software support are required to make third-party copy work.

Customer benefits of data protection with EBS

Customers can protect their storage investments and leverage the following SAN benefits:

- Use of SAN reduces LAN performance impact
- Shared library between all servers increases operational efficiency
- Increased scalability by merging disk and tape on the same SAN
- Lower total cost of ownership

Selling value — qualifying questions

The following questions may be helpful in articulating the customer benefits of data protection with HP Enterprise Backup Solution.

- Do your servers have performance problems attributed to backup?
- Do your system managers spend extra cycles managing disparate tape libraries?
- Could you benefit by automating your data protection?

Customer business need: preventive maintenance

Look for customers who:

- Want to reduce product downtime either through preventive maintenance or corrective actions

Solution: Library and Tape Tools

HP StorageWorks Library and Tape Tools (L&TT) is a collection of storage hardware management and diagnostic tools for nearline tape, nearline tape automation, and nearline archival products. L&TT assembles these tools into a single, convenient program. L&TT 3.4, the latest version of this management tool, offers the following key features:

- **Installation check** — L&TT guides the user through a basic installation check of the product. The software helps the user choose an appropriate host bus adapter (HBA) and SCSI ID(s), ensuring that the device is detected by the system, and verifying essential device functionality. This feature is essentially HTML documentation that helps with the most common installation issues while also describing how to use L&TT to verify the device installation.
- **Device identification** — L&TT clearly identifies the storage products connected to the system, along with essential information on product configuration and status.
- **Troubleshooting tests** — L&TT provides various tests to verify product functionality or to isolate product issues. Tests include device self-tests, read/write tests on drives, exerciser tests for autoloaders and libraries, and specific device utilities.
- **Firmware upgrades** — L&TT provides a convenient way of updating product firmware, enabling users with an Internet connection to take advantage of ongoing enhancements. The software can be configured to check the Web automatically for firmware updates for connected devices, or users can manually check the Web for updates if the automatic update feature is not desired. If updated firmware is available, the program notifies the user, and the user can easily copy the updates to the system.

With libraries, users can upgrade the library and the embedded drive firmware in the same operation. Wherever possible, the embedded drives are updated in parallel to reduce time.

- **Support ticket generation** — If users experience a problem with a storage product, L&TT can generate a support ticket that includes essential information for troubleshooting the problem. As an alternative to telephone support, users can email the support ticket to a support center for assistance.

This information streamlines the support process and enables the support staff to better serve the user if a support call is made later. When the user generates a support ticket for a device, L&TT performs a device analysis test on the device. The support ticket contains generic information about a device, as well as the results of the device analysis test.

Although the device analysis test can be conducted without a support ticket, HP recommends generating a support ticket because the resulting data is presented in a more useful format.

- **Automatic notification of Web updates** — If customers have an Internet connection and Web updates are enabled in the tool preferences, they are automatically informed of the following updates, if available, each time the program is started:
 - New versions of L&TT
 - New firmware files for connected devices
 - New device-specific functionality (such as new or updated tests) for connected devices
- **Operating system support** — L&TT is supported on the following operating systems:
 - Microsoft Windows Server 2003 (IA32 and IPF)
 - Microsoft Windows 2000
 - Microsoft Windows 2000 Advanced Server
 - Microsoft Windows 2000 Professional
 - Microsoft Windows 2000 Server
 - Microsoft Windows 95
 - Microsoft Windows 98
 - Microsoft Windows ME
 - Microsoft Windows NT 4.0
 - Microsoft Windows XP
 - HP-UX v11.X (PA-RISC and IPF)
 - NetWare 5

- NetWare 6
- Tru64 UNIX 5.x
- Linux Red Hat 7.2 (IA32)
- Linux Red Hat 7.3 (IA32)
- Linux Red Hat 8.0 (IA32)
- Linux Red Hat Advanced Server 2.1 (IPF)

Customer benefits of Library and Tape Tools

- Free download (<http://www.hp.com/support/tapetools>) plus quick installation
- Intuitive user interface requires no training
- Easy to install and easy to use
- Web-based smart firmware downloads, updates, and notifications
- Robust firmware downloads perform transparent checks and parallel updates on multidrive devices
- Automatic device failure analysis
- Creates an all-inclusive source of device information for HP support center

Selling value — qualifying question

The following question may be helpful in articulating the customer benefits of preventive maintenance and HP software.

- Would you be interested in a free comprehensive tape hardware diagnostic tool that covers the entire spectrum of HP tape storage products?

Customer business need: data archiving

Look for customers who need to archive reference data that is viewed only occasionally. These customers want to:

- Preserve data for long periods of time
- Satisfy government regulations or customer contractual agreements for archiving data
- Quickly retrieve archived data

Solution: HP optical jukebox family

HP offers a range of archival storage solutions that enable organizations such as medical offices, legal accounting practices, schools, and local retail operations to archive substantial amounts of reference data, while preserving it for the future.

The 9.1GB-based HP magneto-optical jukeboxes bring new levels of capacity and performance to customers' data storage needs.

These jukeboxes lead the market in reliable, cost-effective solutions for the storage and retrieval of high-volume, mission-critical reference data. With storage capacities ranging from 9.1GB to 2.2TB, HP optical drives and jukeboxes fit a wide range of needs. Users can also expand capacity at any time, either by upgrading an existing jukebox or by migrating to a larger system.

Business applications include

- Archiving
- Hierarchical storage management
- Data warehousing
- Unattended backup with online restore of individual files



Key features

- 9.1GB optical disk reads and writes to 9.1GB, 5.2GB, and 2.6GB cartridges; reads 1.3GB and 650MB cartridges
- 100,000-hour mean time between failure (MTBF) rating
- Meets ISO/IEC industry standards for reliable, fail-safe data interchange
- Uses both rewritable and write-once disks
- Includes drivers for Windows 95, Windows 98, Windows 2000, Windows NT V3.51 and V4.0, and Macintosh
- The Bridge FC 4/2 supports Fibre Channel connectivity to HP magneto-optical jukeboxes in the HP-UX environment. Configurable with one or two Fibre Channel ports, the SAN bridge supports jukeboxes with 32 or more slots.
- All large and medium-sized HP magneto-optical jukeboxes are supported by the HP SCSI Bridge FC 4/1 HV and 2/1 LV. These bridges make it possible to physically separate archive data from a host server without introducing the bottleneck of a LAN architecture.
- HP magneto-optical products are supported by the leading application software providers.

Optical jukebox models

The following table lists jukebox models.

Model	Description
Entry level	
9100MX stand-alone drive	Provides up to 9.1GB total capacity on each WORM or rewritable disk for Windows NT environments
220MX jukebox, one or two drives	218.4GB total capacity and slots for up to 24 WORM or rewritable disks for Windows NT
Mid-range	
300MX jukebox, two drives	291.2GB total capacity, two multifunction drives and slots for up to 32 WORM or rewritable disks for Windows NT
600MX jukebox, four drives	582.4GB total capacity, four multifunction drives, and slots for up to 64 WORM or rewritable disks for Windows NT
700MX jukebox, two drives	691.6GB total capacity with two multifunction drives, and slots for up to 76 WORM and rewritable disks for Windows/NT
High-end	
1200MX jukebox, four or six drives	1164GB total capacity, four multifunction drives, and slots for up to 128 WORM or rewritable disks for Windows NT
2200MX jukebox, four, six, or 10 drives	2165.8GB total capacity, 10 multifunction drives, and slots for up to 238 WORM or rewritable disks for Windows NT

Customer benefits of HP optical jukeboxes

- Provides a permanent storage solution for high-volume reference data, while allowing quick access to data.
- Supports customers with data integrity responsibility and/or regulatory liability.
- Scalable to meet current and future business needs and has a 100-year media shelf life.
- HP magneto-optical solutions have proven reliability and are built on the strength of magneto-optical storage technology.

Selling value — qualifying questions

The following questions may be helpful in articulating the customer benefits of HP optical jukeboxes.

- Do you have large volumes of data that must be stored and accessible over a long period of time?
- Are you contractually committed by regulatory requirements to backup data?

Summary

- Storage consolidation
 - Improved utilization rates
 - Lower cost per GB in compact footprint
- Data protection and management
 - Use of SAN reduces LAN performance impact
 - Shared library between all servers increases operational efficiency
 - Increased scalability by merging disk and tape on the same SAN
 - Lower total cost of ownership
- Preventive maintenance
 - Free diagnostic tool
 - Requires no training
 - Convenient firmware upgrades
 - Automatic device failure analysis
- Enterprise tape libraries
 - HP StorageWorks ESL E-Series
 - HP StorageWorks ESL 9000 Series
- Mid-range tape libraries
 - HP StorageWorks MSL6000 Series
 - HP StorageWorks MSL5000 Series
- Ultrium LTO tape drives
- SDLT tape drives
- Enterprise Backup Solution (EBS)
- Library and tape tools (L&TT)
- HP Optical Jukebox family

Learning check

1. Which of the following is the leading cause of data loss?
 - a. Software malfunction
 - b. Viruses
 - c. Hardware or system malfunction
 - d. Human error
2. Which is the appropriate selling guideline to follow when positioning LTO and SDLT tape drives with customers?
 - a. If the customer has a preference for DLT or SDLT, persuade the customer to migrate to LTO.
 - b. If the customer does not have a preference, lead the sales discussion with either LTO or SDLT.
 - c. If the customer has a need for SDLT, close the sales discussion with SDLT.
 - d. If the customer has a preference for LTO, explain the benefits of SDLT.
3. The ESL9000 series is the right solution when the customer needs:
 - a. Over 600 cartridge slots
 - b. Mixed drive capability
 - c. Native Fibre Channel drives
 - d. Bulk loading/unloading
4. Which of the following tape libraries supports up to four Ultrium 460 tape drives per module?
 - a. HP StorageWorks MSL6060
 - b. HP StorageWorks MSL6030
 - c. HP StorageWorks MSL5052DLX
 - d. HP StorageWorks MSL5052SL
5. The HP StorageWorks MSL5000 family supports the mixing of LTO and SDLT tape drives within the same library.

☐ True

☐ False

6. What customer need would you be exploring by asking the question: “Are your backup systems all over the place and taking up valuable floor space?”
 - a. Media management
 - b. Data protection
 - c. Interoperability
 - d. Storage consolidation
7. Which of the following describes the HP StorageWorks ESL9595L2?
 - a. SDLT 160/320 drives, up to 595 slots, up to 1728GB/hour native backup performance
 - b. Ultrium 460 drives, up to 322 slots, up to 432GB/hour native backup performance
 - c. Ultrium 460 drives, up to 595 slots, up to 1728GB/hour native backup performance
 - d. Ultrium 460 drives, up to 500 slots, up to 864GB/hour native backup performance
8. Which **two** of the following questions are most appropriate to ask when qualifying potential data archiving opportunities?
 - a. Are your servers having performance problems attributed to backup?
 - b. Are you contractually committed by regulatory requirements to backup data?
 - c. Are your system managers spending extra cycles managing disparate tape libraries?
 - d. Would you like to protect against losing files by performing scheduled snapshot backups?
 - e. Do you have large volumes of data that must be stored and accessible over a long period of time?
9. The E-Series platform offers this advantage over the ESL9000 series.
 - a. Mixed drive capability
 - b. Ultrium 320 technology
 - c. 16 drives in a single frame
 - d. Future support of native Fibre Channel drives

Objectives

After completing of this module, students should be able to:

- Identify SAN interconnect customer challenges.
- Identify the HP SAN interconnect strategy.
- Describe the HP switch and director market positioning.
- Describe the benefits of SAN interconnect switches.
- Describe the HP strategy for IP storage.
- Describe the benefits of the HP iSCSI router and vendor solutions.
- Use appropriate questions to qualify opportunities in the SAN interconnect target markets.

HP StorageWorks SAN interconnects

HP supports a variety of SAN interconnects.

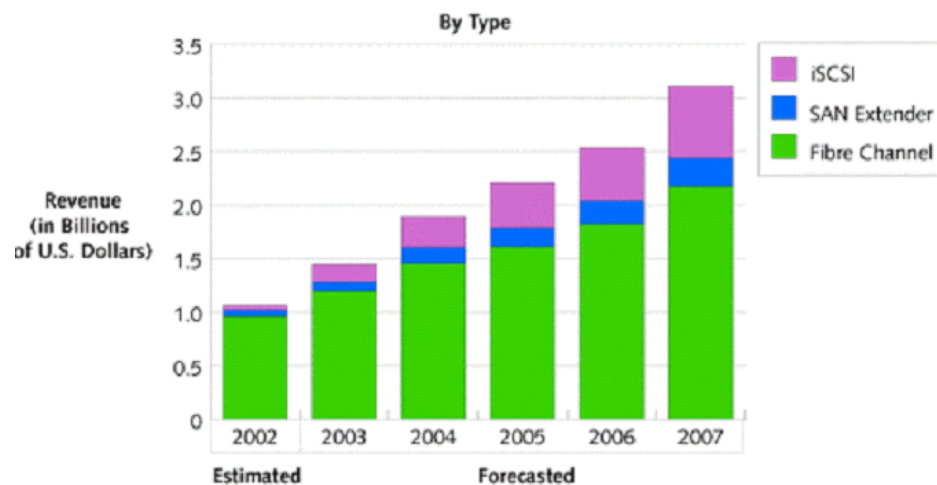
- **SAN switch** — A Fibre Channel network infrastructure component to which multiple nodes attach. Unlike hubs, switches typically have internal bandwidth that is a multiple of link bandwidth, and the ability to rapidly switch node connections from one to another. A typical switch can accommodate several simultaneous full link bandwidth transmissions between different pairs of nodes.
- **SAN director** — A Fibre Channel network infrastructure component to which multiple nodes attach. Typically used at the center of a large SAN (with edge switches on the periphery), these devices have redundant architectures for high availability and provide high bandwidth.
- **iSCSI router** — iSCSI-to-Fibre Channel interconnect that enables universal access to storage devices and SANs over standard Ethernet-based TCP/IP networks.
- **SAN extender**— Refers to a variety of devices used to connect two Fibre Channel switches greater than 500 meters for 1 Gbps Fibre Channel switch pair or greater than 300 meters for a 2 Gbps Fibre Channel switch pair. Enables inter-network access to isolated islands of SANs over wide area (WAN) and metro area (MAN) networks.
- **Host bus adapter** — A printed circuit assembly that transmits data between the host system's internal bus and the external Fibre Channel link and vice versa.

Storage networking forecast

The Yankee Group Global Storage Networking Forecast details forecasts of the global storage networking market from 2002 to 2007. The total 2002 market of US\$3.9 billion grows at an average of 28 percent into a \$13.3 billion market in 2007.

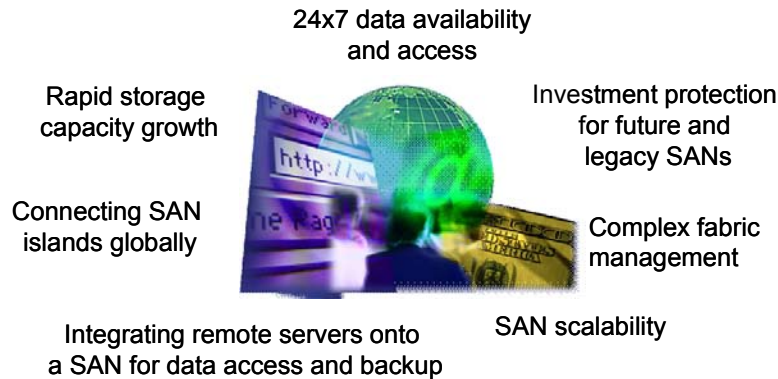
The largest component is FC, with FC switch revenue growing from US\$726 million in 2002 to US\$1.6 billion by 2007, with more than 5 million ports forecasted for shipment. Although smaller in 2002, FC HBA revenue overtakes FC switch revenue, growing into a US\$1.7 billion market globally. This almost surpasses the SAN extender and iSCSI markets combined, which in 2007 are forecast for US\$1.8 billion globally.

Global Storage Networking Forecast by Type



Source: The Yankee Group, May 2003

Customer challenges: SAN interconnects



Today's industry answer

- Too many choices
- Too many technologies
- Changing vendor strategies
- Piece-part solutions

HP StorageWorks SAN today

- A network platform for end-to-end network storage solutions
- HP partners with the “best in class” storage networking component provides to deliver complete, integrated, end-to-end network storage solutions.
- ENSAextended is the HP strategy for delivering **the adaptive storage infrastructure**. Storage area networks are a significant component in delivering the adaptive infrastructure. In turn, the SAN defines the adaptive **fabric** infrastructure.
- Interconnects are the “network” in network storage. They provide the connectivity base for the high value-add storage applications offered by HP, management tools, and networked storage arrays and NAS products.

HP market differentiators: the 3 R's

- Reducing risk
 - Proven solutions: IOP continuous testing; extensive partnering & testing with vendors
- Reducing complexity
 - “Right fit” storage design
 - SAN architecture rules and *Design Guide*
 - Solution blue-prints for immediate deployment
- Reducing costs
 - Enables fullest SAN utilization—NAS/SAN fusion; iSCSI bridging support

HP competitive differentiation

- **SAN architecture rules** — As part of this “layer of differentiation,” HP provides a *Design Guide* that includes:
 - ♦ Architecture guidance
 - ♦ Massive configuration
 - ♦ Implementation best practices
 - ♦ Incorporation of new technologies
- **Solution blue-prints** — HP offers solution blue-prints that define a solution to a specific problem, demonstrate in advance the ROI, provide all the key information, reduce implementation risk, and provide guidance on flexibility/scalability.
- **Interoperability testing** — HP conducts portfolio testing to provide common, end-to-end proven interoperability, spanning online storage, infrastructure and NAS, nearline storage, and storage software.
- **Partner auditing and testing** — HP does extensive collaboration (HP vendor testing plans, HP labs at vendor sites, HP engineering auditing) and certifies SAN extensions and WDM (wavelength division multiplexer) devices.
- **Fabric software and OVSAM integration** — HP uses standards-based management (CIM) integrated with fabric software and OpenView Storage Area Manager

HP SAN interconnect strategy

- Provide range of SAN connectivity options for customer business needs
- Incorporate the industry's leading infrastructure vendors into a comprehensive portfolio of SAN solutions
- Leverage HP ability to integrate with servers and other technologies for complete infrastructure solutions
- Provide seamless integration with software tools for management, ranging from network management to complete system management

HP SAN interconnect benefits

Enhancing operational efficiencies is high on the list of most customers.

- Improving IT productivity
 - Increasing the productivity of storage administration personnel and increasing the utilization of heterogeneous storage and IT assets
- Simplifying storage management and increasing control
 - Reduce points of management within the SAN fabric and enable operating system independence for storage management applications
- Extending and protecting SAN investments
 - Seamlessly extending existing SAN switch fabrics and enabling high-confidence, low-risk SAN planning for the future

SAN interconnect qualifying questions

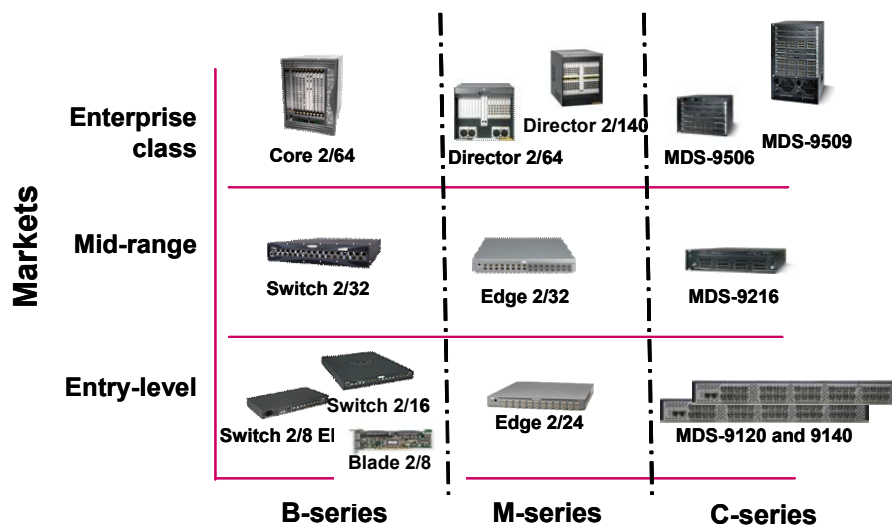
- Are you experiencing rapid storage growth of storage but are forced to work within decreasing budgets?
- Do you need to consolidate storage resources quickly?
- Are you running business-critical applications that require the highest levels of availability?
- Are you interested in enabling system managers to monitor and manage more networked storage?
- Would you like to improve server productivity and network performance by redeploying a dedicated backup server from having to handle all backup data?
- Would you like to consolidate stranded remote servers into an existing SAN?
- Would you like to connect SAN islands?

Switches and directors

- Switches
 - Suitable for SAN deployments from entry-level to enterprise
 - Amenable to fabric growth over time
 - Switches connected to one another via E_Port cascading
 - Reliable fabric investment
- Directors
 - Developed for very large SANs
 - SAN fabrics (100's of ports)
 - Designed to reside in the middle of a large SAN
 - Configured with redundant elements for high availability
 - Design minimizes loss of bandwidth from ISLs

Interconnect product lines

Infrastructure alternatives that span the enterprise include:



Name simplification/alignment

HP offers breadth of choice across all markets:

- HP-branded McDATA technologies (B-series)
- HP-branded Brocade technologies (M-series)
- Cisco-branded technology reseller (C-series)

HP switch and director product lines

	StorageWorks branded		Reseller branded
	B-series	M-series	C-series
Director	<ul style="list-style-type: none"> ■ Core switch is a network device to unite SAN islands at the SAN core ■ Full solution interoperability, including CASA ■ Hardware five 9s capable; non-disruptive software updates 	<ul style="list-style-type: none"> ■ HA proven performance, five 9's, nondisruptive updates ■ Market share leading director product ■ SFPs included ■ Full solution interoperability 	<ul style="list-style-type: none"> ■ Tightly integrated multiprotocol support ■ HA performance, five 9s, non-disruptive updates ■ Most HP StorageWorks solutions supported ■ Management and fabric services software included
Edge switches	<ul style="list-style-type: none"> ■ Market share leader ■ Largest installed base ■ Mature technology ■ Full solution interoperability, including CASA support 	<ul style="list-style-type: none"> ■ Flexible port upgrades ■ SFPs included ■ Full solution interoperability ■ Same FW across products 	<ul style="list-style-type: none"> ■ Same FW across products ■ Most HP StorageWorks solutions supported ■ SFPs included ■ Management and fabric services software included
Market positioning	<ul style="list-style-type: none"> ■ Market share leader ■ Mature technology 	<ul style="list-style-type: none"> ■ Market leader HA director product ■ Preferred solution in EMC environments 	<ul style="list-style-type: none"> ■ IP networking market share leader ■ Evolutionary integration path with HP products

HP switch and director SAN support

	StorageWorks branded		Reseller
	B-Series	M-Series	C-Series
Operating system	HP-UX, Windows 2000, Windows DataCenter, Solaris, Netware, Linux, AIX, OpenVMS, Tru64 UNIX	HP-UX, NT, Windows 2000, Windows 2003, Windows DataCenter, Solaris, NetWare, Linux, AIX, OpenVMS, Tru64 UNIX	HP-UX, NT, Windows 2000, Windows 2003, Solaris, Linux, AIX, OpenVMS, Tru64 UNIX
Clustering	HP TruCluster, OpenVMS cluster, HP MC/ServiceGuard, HACMP Lifekeeper, MSCS NetWare clusters, SUN clusters, Veritas clusters	HP TruCluster, OpenVMS Cluster, HP MC/ServiceGuard, HACMP LifeKeeper, MSCS NetWare clusters, SUN clusters, Veritas clusters	HP TruCluster, OpenVMS Cluster, HP MC/ServiceGuard, HACMP LifeKeeper, MSCS NetWare clusters, SUN clusters, Veritas clusters, Metro clusters
Arrays	MSA1000, EVA, XP, VA, MA8000/EMA12000	MSA1000, EVA, XP, VA, MA8000/EMA12000	MSA1000, EVA, XP, VA, MA8000/EMA12000
Software and applications	EBS, Secure Path, Autopath, OVSAM, Continuous Access, CASA, DRM	EBS, Secure Path, Autopath, OVSAM, Continuous Access, DRM	EBS, Secure Path, AutoPath, OVSAM, Continuous Access, DRM
Scaling	28 switches, 1280 total ports	24 switches, 1632 total ports	Multiswitch up to 512 total ports
IP support	iSCSI bridging, FCIP SAN extension, WDM, NAS/SAN fusion	iSCSI bridging, FCIP SAN extension, WDM, NAS/SAN fusion	iSCSI bridging, tightly integrated FCIP SAN extension, DWDM, CWDM, NAS/SAN fusion

B-Series (Brocade) features

Note

The MSA is covered in the course entitled, *Selling HP Business Class Solutions*.

Features	HP StorageWorks SAN Switch 2/8 EL	HP StorageWorks SAN Switch 2/16*	HP StorageWorks SAN Switch 2/32*	HP StorageWorks SAN Core 2/64*
Targeted environment	Entry-level Mid-range	Entry-level Mid-range	Mid-range, Enterprise	Mid-range, Enterprise
Port bandwidth	200MB/s	200MB/s	200MB/s	200MB/s
OS support	Refer to <i>HP StorageWorks SAN Design Guide</i>			
Storage system support	MSA1000 MA8000 EMA12000/16000 VA EVA XP	MSA1000 MA8000 EMA12000/16000 VA EVA XP	MSA1000 MA8000 EMA12000/16000 VA EVA XP	MSA1000 MA8000 EMA12000/16000 VA EVA XP
Ports	8	16	32	64
Form factor	1U	1U	1.5U	14U
Fabric-wide management	Yes	Yes	Yes	Yes
Hot-plugs	No	Yes	Yes	Yes
Redundant power	No	Yes	Yes	Yes

* Requires new licensing process (see next section)

Key product differentiators for B-series product line

- Manageability
 - Easy-to-install-and-use software tools for centralized storage management that reduce administrative workload and increase ROI
- Software interoperability
 - Interoperability with SAN applications and management tools including OVSAM
- Scalability
 - “Pay as you grow” backward and forward compatibility that provides a seamless migration path and investment protection
- Easy to implement
 - Preconfigured, tested, and certified HP SAN solutions
 - Documented in the *SAN Design Guide* and solution blueprints

When should to lead with a B-series technology-based solution?

- Customer has a preference for Brocade infrastructure products
- Customer already has a big investment in Brocade infrastructure products
- Customer has a preference for products from the market share leader
- Price-sensitive customers at the entry level that want low port count connectivity at the lowest cost (SAN switch 2/8 EL)

Switch software: Brocade PowerPak options

Customers may purchase optional software for Brocade switches by three basic methods:

- Fully configured as part of a value-priced PowerPak switch and software bundle
- Full package of software for customers who purchased “base” configurations
- Individually by application

Brocade switch software options

Base configuration	PowerPak
■ Web Tools	■ Base configuration
■ Zoning	■ Fabric watch
■ Quick Loop Fabric Assist (SAN switch 2/8-EL and SAN switch 2/16)	■ Trunking
	■ Advanced performance monitoring
	■ Extended fabrics
	■ Remote switch

- Base switch configurations for the 2/8-EL, 2/16, and 2/32 ship with web tools and zoning standard
- Base configuration for core switch ships with web tools, zoning, and fabric manager standard

Intelligent SAN switch architecture components

Brocade's intelligent SAN switch architecture is comprised of:

- **SAN/SAM management application** — Leading applications use the Fabric Access API to unlock the intelligence in the SAN through integration of Fabric Watch, Advanced Performance Monitor, and Fabric Manager with HP OpenView Storage Area Manager.
- **Fabric Manager (application)**
 - Fabric Manager is a highly scalable, Java-based management station application that manages multiple switches and multiple fabrics (up to eight) in real time. Fabric Manager assists SAN administrators with the configuration, monitoring, dynamic provisioning, and daily management of SANs.
 - Fabric Manager also helps to lower the cost of SAN ownership by facilitating SAN management tasks. It enables the global integration and execution of processes across multiple fabrics and provides SAN administrators with rapid access to critical SAN information across multiple fabric types, including both Fabric OS SANs and enhanced Secure Fabric OS SANs.
- **Fabric OS (Advanced Fabric Services)** — Advanced Fabric Services help simplify management and administration, increase storage and server availability, and increase performance. They are part of the fabric operating system.
- **Third-generation ASIC technology** — This is the hardware on which the other software layers sit.

Advanced Fabric Services

Depending on the Brocade switch, the following software features may be standard in the base configuration or optional PowerPak components. Switches can be managed from Web Tools, HP OpenView, SNMP, IP, and API interfaces.

Advanced Fabric Services components

Feature	Description
Web Tools	Web Tools is an intuitive and graphical interface that enables organizations to monitor and manage Brocade SilkWorm Fibre Channel Fabric Switches and small Brocade SAN fabrics. Using a Java-capable Web browser from standard laptops, desktop PCs, or workstations from any location within the enterprise SAN, administrators can perform management tasks.
Advanced zoning	In the 2Gb/s generation of switches, WWN zoning and access control are enforced by hardware providing the same simple administration that was previously only enforced with software. Administrators can organize a physical fabric into logical groups and prevent unauthorized access by devices outside the zone.
QuickLoop/fabric assist	QuickLoop enables Fibre Channel private-loop devices in legacy environments to migrate to a fully scalable fabric in a SAN.
Inter-Switch Link (ISL) trunking	ISL is high-performance enhanced trunking. An optional license logically groups up to four E-ports to provide a high bandwidth trunk between two 2Gb/s switches. Each switch needs its own license. The switch operating system views the trunk as a single, high bandwidth resource (up to 8Gb/s) when routing connections between switches. Each 16-port switch can have a total of four separate 4-port trunk groups.
Advanced performance monitoring	This enabling technology provides the ability to monitor and watch specific fabric metrics from a SID (source ID) to a DID (destination ID), which creates a method to fine-tune and scale your fabric more efficiently. Performance monitoring also provides a powerful tool for maintaining overall balanced performance by enabling an early warning detection of hot-spots within the fabric.
Fabric Watch	Fabric Watch enables each switch to monitor the SAN for potential faults- and automatically alert network managers to problems before they become failures. Fabric Watch tracks a variety of SAN fabric elements, events, and counters. Monitoring fabric-wide events, ports, SFPs (small form factor pluggables), and environmental parameters, permits early fault detection and isolation as well as performance measurement. Each switch requires its own license.
Extended Fabric	Extended Fabric extends all of the scalability, reliability, and performance benefits of Fibre Channel storage area networks beyond the native 10km distance specified by the Fibre Channel standard.
Remote switch	Remote switch fabric functions with the aid of a bridging device or network bridge. The network bridge supports both Fibre Channel physical interfaces as well as secondary non-Fibre Channel Internet Protocol physical interfaces.

M-series (McDATA) features

Features	HP StorageWorks Edge Switch 2/24	HP StorageWorks Edge Switch 2/32	HP StorageWorks Director 2/64	HP StorageWorks Director 2/140
Targeted environment	Mid-range, Enterprise	Mid-range, Enterprise	Enterprise	Enterprise
Port bandwidth	200MB/s	200MB/s	200MB/s	200MB/s
Aggregate device bandwidth	4800MB/s	6400MB/s	12800MB/s	28000MB/s
OS support	Refer to <i>HP StorageWorks SAN Design Guide</i>			
Storage system support	MSA1000 MA8000 EMA12000/16000 VA EVA XP	MSA1000 MA8000 EMA12000/16000 VA EVA XP	MSA1000 MA8000 EMA12000/16000 VA EVA XP	MSA1000 MA8000 EMA12000/16000 VA EVA XP
Ports	24	32	64	140
Form factor	1U	1.5U	9U	12U
Fabric-wide management	Yes	Yes	Yes	Yes
Hot-plugs	Yes	Yes	Yes	Yes
Redundant power	Yes	Yes	Yes	Yes

Key product differentiators for M-series

- Rich set of HA features
 - Firmware update and activation without downtime delivers continuous application availability on a single fabric configuration
 - Call-home capabilities for proactive monitoring
- Unique convenience/usability attributes
 - Common firmware across entire portfolio of directors and switches
 - Flexport technology — port activation in 8-port increments allows for the addition of ports on an as-needed basis without disruption of the switch or fabric
 - Low service action impact — for port card failures, service impact is limited to 4 ports
 - SFPs included

When to lead with an M-series technology-based solution

- Customer has a preference for McDATA infrastructure products
- Customer already has a big installed base and investment in McDATA infrastructure products
- Green field situations where the customer is running mission-critical applications, wants to implement a SAN, and has not yet installed any switch infrastructure products
- Customer is a current or former EMC customer (existing SANs with EMC typically have 1Gb McDATA products installed)
- Customer has InRange infrastructure products, and is looking to replace these with an HP infrastructure solution
- Customer is looking for a low port-count (8-, 16-, or 24-ports) entry point into a networked storage environment, but requires full switch functionality and expects to scale up at a later date

C-Series (Cisco) features

- Multiprotocol capability
 - Integrated SAN extension allows integration of FC, FCIP, iSCSI into a single platform. Disaster recovery and SAN extensions implementations can be achieved without introducing additional platforms
- Configuration flexibility
 - Expandable in 16- and 32-port increments with no service disruptions
 - May be configured as a high-performance, non-blocking director, high-port-count core switch, or a core/edge “SAN in a box,” eliminating the need for ISLs.
 - Any 16 ports can be used for aggregation to create a single “port channel” high-speed trunk between switches
 - Highest port count switch supporting up 224 ports in a single switch
- Integrated management
 - All software included; no additional software licenses to purchase for fabric management and fabric services
 - Integration with enterprise storage management — OVSAM
 - Enables ease of management and scalability with Virtual SANs
- High performance
 - Highest-performance Fibre Channel switching platform on the market. Proven line rate performance at all frame sizes on a fully loaded chassis (112 ports). With 1.44Tb/s bandwidth to support 10Gb in the future.

When to lead with a C-series technology-based solution

- Only when the customer has a preference for Cisco infrastructure products, and the lead has been generated by Cisco
- And, when the environment matches the supported environment

Note

Always present HP breadth of infrastructure solution choices. When possible, promote HP-branded M-series and B-series product lines.

Fabric interoperability**Heterogeneous fabric technologies**

- Connecting different fabric vendors' products together within one fabric
- New freedom to leverage heterogeneous fabrics for unprecedented flexibility and choice in storage network deployment
- Customer simply chooses the best fabric solution to meet their needs with integration peace of mind

Standards-based communication

- Standard-based fabric interoperability guaranties long-term open choice and investment protection
- Reversed engineered solutions are not sustainable and add significant customer risk

Benefits of SAN switches and directors

- Ease of management by allowing the SAN to be able to grow without creating an additional administrative burden
- High availability to decrease lost revenue and opportunity costs associated with downtime
- Scalability for port count, fabric, and manageability, so that future growth needs can be addressed easily
- Investment protection to incorporate existing infrastructure while providing new, advanced features

Why multiprotocol networks?

Why IP (Internet Protocol)?

- IP backbones span the globe
- Large pool of skilled people
- Security, other attractive features
- Possible cost benefits

Why not IP...for storage?

- Need to port storage management applications
- Storage knowledgeable IP resources
- Performance, reliability

Protocols for storage over IP networks

There are several protocols for delivering block-level storage data over IP-based networks:

- FCIP (Fibre Channel over IP) - encapsulates Fibre Channel in an IP packet
 - Connects FC SAN islands through an IP fabric
 - Connects FC devices directly to an IP fabric
- iFCP (Internet Fibre Channel Protocol) — creates a Fibre Channel tunnel through an IP network
 - Connects FC SAN islands through an IP fabric
- iSCSI (Internet SCSI)– SCSI protocol in IP packets
 - Interconnects iSCSI servers with FC or iSCSI storage

HP strategy for IP storage integration

The HP strategy for IP storage (or multiprotocol) integration is to enhance and extend ENSA through the continued evolution of Fibre Channel functionality and by measured exploitation of IP storage utilizing both **FCIP** and **iSCSI**. The five-point plan is to:

- Enable Fibre Channel as the data center foundation
- Lead development of the market for IP storage
- Enable solutions-centric deployment of IP in storage networks
- Introduce iSCSI to help customers migrate to networked storage
- Leverage iSCSI to support blade server configurations

SR2122 iSCSI-2 router features

Feature	Description
2Gb/s E-ports	Supports 1Gb/s Ethernet link
2 FC ports	Supports FC-AL, FC-AL-2 point to point, switched fabric topologies Automatically negotiates to 1Gb/s or 2Gb/s, full-duplex FC communications
Media types	Small form-factor pluggable (SFP) SWL up to 500m LWL up to 10 km
Management access	10/100 Ethernet (RJ-45) for out-of-band management and RS-232 serial port for in-band management
Management	Telnet; SNMP; Cisco Web Tools, OVSAM
Speed	> 140Mb/s

SR2122-2 iSCSI customer benefits

- Extends SAN benefits by using IP network as a ubiquitous, lower performance complement to Fibre Channel
- Allows customers to quickly and easily add “stranded” servers, located across MAN/WAN, to Fibre Channel SAN
- Increases leverage of existing IT staff expertise and familiarity with Fibre Channel and TCP/IP
- Leverages SAN for backup vs. expanding legacy tape
- Provides a safe start for integrating iSCSI technologies into an overall storage strategy

Cisco 9000 IP module

- IP service module provides multiprotocol support to C-series MDS 9000 family
- Support for iSCSI and FCIP in addition to Fibre Channel (FC)
- Cost-effective SAN solution for the enterprise, departments, work groups, and core-edge environments
- Ease of administration from integrated management reduces TCO
- Expanding the benefits of the FC SAN (reduced TCO and storage consolidation) to servers throughout the data center and to isolated “SAN islands”
- Simplifies data protection and business continuance strategies by enabling backup, remote replication, and disaster recovery over WAN distances using open-standard FCIP tunneling
- Simplifies SAN management by seamlessly integrating management of IP and FC connected components

Summary

- Types of storage interconnects covered in this module:
 - HP StorageWorks SAN switches and directors and Cisco switches and directors
 - HP StorageWorks network storage routers
 - HP StorageWorks iSCSI router
 - Cisco 9000 IP module
- HP interconnect market differentiators (3 R's):
 - Reduce risk with proven solutions and testing
 - Reduce complexity by design guides and blue-prints to speed deployment
 - Reduce costs: enabling the fullest SAN utilization with NAS/SAN fusion and iSCSI bridging support
- HP offers breadth of choice of switches and directors across all markets:
 - HP-branded McDATA technologies
 - HP-branded Brocade technologies
 - Cisco-branded technology reseller
- SAN switch and director benefits include:
 - Ease of management for seamless SAN growth without additional administrative burden
 - High availability to minimize the impact of downtime
 - Scalability of port count, fabric, and manageability
 - Protection of SAN investments
- Switch software helps maximize performance, optimize resource utilization, simplify management, and increase ROI
- Network storage router benefits include
 - Freeing up server resources to conduct revenue-generating tasks and rack space for other SAN products
 - Improving worker productivity with fewer LAN bottlenecks
 - Providing security for access and Windows NT/UNIX resource sharing

- The HP strategy for IP storage is to continue the evolution of FC functionality and use FCIP and iSCSI in a measured way.
- HP StorageWorks SR2122-2 iSCSI router benefits include:
 - Expands SAN benefits and reduces the cost of storage consolidation for remote servers
 - Bridges remote servers to network storage routers and tape libraries for SAN backup
 - Leverages expertise of existing IT staff expertise

Learning check

1. Which of the following **is not** a SAN interconnect customer challenges?
 - a. Management of the storage ecosystem
 - b. Linking SAN islands
 - c. Connecting remote servers to the SAN for data access and backup
 - d. 24 x 7 data availability and access
2. Identify one way HP differentiates itself in the SAN interconnect market.
 - a. By offering leading edge- and director-class switches
 - b. By leveraging its experience in server products
 - c. By providing proven, continuously tested solutions
 - d. By fusing DAS and NAS
3. Which of the following descriptions applies to the Fabric Watch software?
 - a. Enables Fibre Channel private-loop devices in legacy environments to migrate to a fully scalable Fabric in a SAN
 - b. Monitors fabric-wide events, ports, SFPs (small form factor pluggables), and environmental parameters; permits early fault detection and isolation as well as performance measurement.
 - c. Assists SAN administrators with the configuration, monitoring, dynamic provisioning, and daily management of SANs
 - d. An intuitive and easy-to-use graphical interface that enables organizations to monitor and manage Brocade SilkWorm Fibre Channel Fabric Switches
4. Which of the following is a benefit of a SAN switch and director?
 - a. Frees server resources to conduct revenue-generating tasks
 - b. Allows workers to be more efficient without LAN bottlenecks
 - c. Aids in diagnosing problems to the individual LUN before device failure
 - d. Scalability in terms of port count, fabric, and manageability so customer growth requirements can be easily addressed

5. Which of the following is a SCSI to Fibre Channel bridge that connects SCSI tape libraries to a SAN?
 - a. San switch
 - b. iSCSI router
 - c. Network storage router
 - d. SAN director
6. Which of the following statements summarizes the HP strategy for IP storage?
 - a. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by measured exploitation of IP storage utilizing both FCIP and iSCSI
 - b. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by widespread adoption of IP storage utilizing both FCIP and iSCSI
 - c. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by widespread adoption of IP storage utilizing both iFCP and iSCSI
 - d. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by measured exploitation of IP storage utilizing both iFCP and iSCSI
7. What is one of the benefits of HP iSCSI router?
 - a. Provides better availability than traditional routers
 - b. Allows customers to quickly and easily add “stranded” servers located on a metro- or wide area LAN to a Fibre Channel SAN for data access and backups
 - c. Allows workers to be more efficient without LAN bottlenecks
 - d. Encapsulates SCSI commands for routing to Fibre Channel networks
8. Which of the following is NOT a feature of the HP SAN interconnect strategy?
 - a. Provides seamless integration with software tools for management, ranging from network management to complete system management
 - b. Supports seamless expansion of tape libraries for additional flexibility within the data center
 - c. Provides a range of SAN connectivity options for customer business needs
 - d. Incorporates the industry’s leading infrastructure vendors into a comprehensive portfolio of SAN solutions

9. If a customer answers “yes” to the qualifying question, “*Would you like to consolidate stranded remote servers into an existing SAN?*” the most immediate solution for consideration would be _____.
- a. SAN Director
 - b. iSCSI Router
 - c. Fabric Switch
 - d. Network Storage Router
10. Which of the following is NOT a characteristic of Director-level interconnects?
- a. Developed for very large SANs
 - b. Designed to reside in the middle of a large SAN
 - c. Suitable for SAN deployments from entry-level to enterprise
 - d. Design minimizes loss of bandwidth from ISLs (inter-switch links)

Objectives

After completing this module, students should be able to:

- Identify storage management market opportunities and target customers.
- Describe HP OpenView Storage Area Manager (SAM) business value.
- Describe the features and benefits of HP OpenView SAM including the following components:
 - HP OpenView Storage Allocator
 - HP OpenView Storage Accountant
 - HP OpenView Storage Optimizer
 - HP OpenView Storage Builder
 - HP OpenView Storage Node Manager
- Use appropriate questions to qualify opportunities in storage management target markets.
- Describe the features and benefits of HP OpenView Storage Provisioner.

IT management and ROI

According to a 2003 study by IDC, enterprise customers have met the challenge of demonstrating that IT managers can have a substantial impact on their businesses' bottom line. Indeed, the study shows that IT should be seen as a "hero," rather than a business burden or a costly "overhead."

IDC found that IT managers can move from cost center to profit center by enabling their enterprises to realize substantial IT cost savings and end-user productivity gains using HP OpenView IT service management software. With HP OpenView, IT managers can manage IT network, system, and applications resources in support of business operations more effectively.

IDC determined that the HP OpenView software delivered a significant and rapid bottom-line "return on IT management" in three areas: IT productivity, IT management efficiency, and application availability.

IDC polled HP OpenView customers, measured the efficiency of IT management tools and processes, and calculated that companies deploying HP OpenView reduced downtime by 79%, with an average return on investment of 1,296%. This translated to an average savings in lost revenue of \$74,468 per 100 users over 3 years and an average savings from increased user productivity of \$93,712 per 100 users.

In today's business environment, IT managers must be able to justify IT expenditures based on the business value that these investments deliver. The IDC study demonstrates the value of software that can manage complex, distributed, heterogeneous infrastructures from the element and operations level to the business service level.

Shifting perspectives on enterprise storage

As the demand for storage continues to explode, perspectives on enterprise storage management are beginning to shift. In the past, storage was viewed from a “point” perspective, typically as an add-on direct-attached storage (DAS) device for individual servers.

Now, a comprehensive integrated storage strategy is necessary to efficiently and cost-effectively address growing enterprise needs—a strategy that maximizes the use of existing resources **and** reduces administrative burdens so that more storage can be managed by the same number of administrators.

HP OpenView Storage Area Manager

HP OpenView Storage Area Manager (SAM) software delivers centralized, enterprise-wide device, capacity, and performance management across distributed, multivendor storage resources and infrastructures

- Storage usage metering and billing
- Logical storage assignment
- Host/LUN access control

HP OpenView SAM software simplifies and automates the management of storage resources and infrastructure. SAM has a modular building block architecture that consists of five functional modules:

- Storage Node Manager
- Storage Builder
- Storage Optimizer
- Storage Accountant
- Storage Allocator

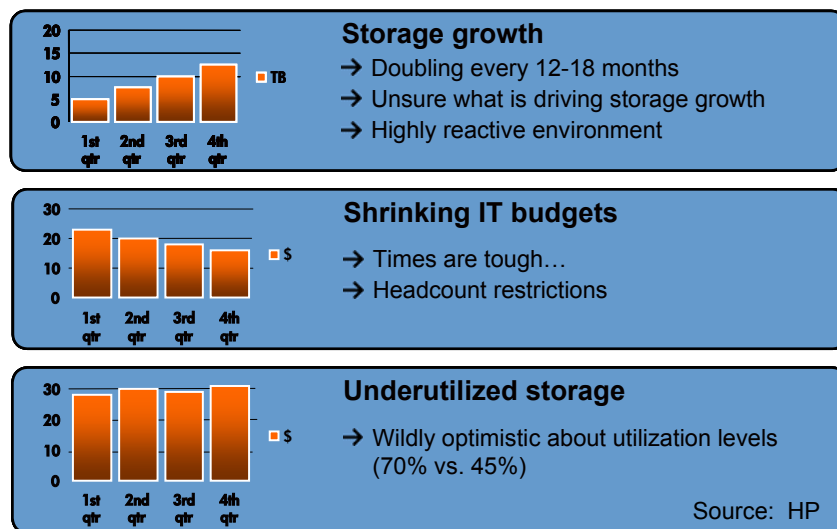
These modules allow customers to manage storage growth with a single solution. From its central console, SAM enables customers to effectively monitor, manage, optimize, and plan storage service availability, performance, usage, cost, and growth. SAM also enables management and planning for capacity related to Oracle and Microsoft Exchange applications.

SAM helps increase administrator efficiency and reduces the cost of managed storage. SAM helps you define, monitor, and measure storage service levels thus enabling management and control of the storage environment and applications to support the storage utility based on the ENSAextended architecture. Its integration with enterprise management tools via Smart Plug-Ins and SDK helps deliver an integrated IT service.

What is new with OpenView SAM V3.1?

- Enables Oracle and Exchange capacity management and planning.
- Increases efficiency by centrally managing application storage and reducing the cost of storage associated with applications.
- Integration with HP Systems Insight Manager provides a single point of access for managing the enterprise network storage infrastructure along with other HP devices. This integration enables the use of many of the core services of Systems Insight Manager in a single console, providing unparalleled breadth of device management for HP servers, clients, storage, power, and printer products.

Customer challenges

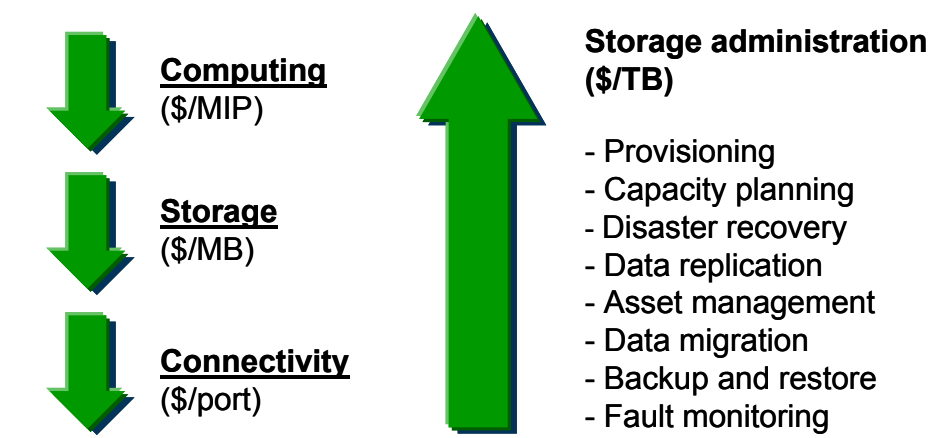


Storage challenges are numerous. However, the primary challenges that customers talk about can be grouped into the following three issues:

1. Storage growth rates of anywhere from 50–200% per year are not uncommon. The challenges accompanying these rates are compounded by the fact that for most storage managers, the origin of the growth is unknown, resulting in a highly reactive environment.
2. At the moment, almost no industry sector is able to escape the fact that the economy is declining. This means that infrastructure plans that may have been put in place last year are now being implemented with smaller budgets. Most storage managers need to find a way of doing more with less or having to implement smaller projects or subsections of larger projects.
3. Storage managers typically overestimate their utilization rates on arrays by a great percentage. Often, storage managers assume 70% rates when the rates are actually closer to 40–50%.

Increasing storage administration costs

While the cost of computing, storage, and connectivity components is decreasing, storage budgets as a whole are an increasingly larger portion of an IT department budget.



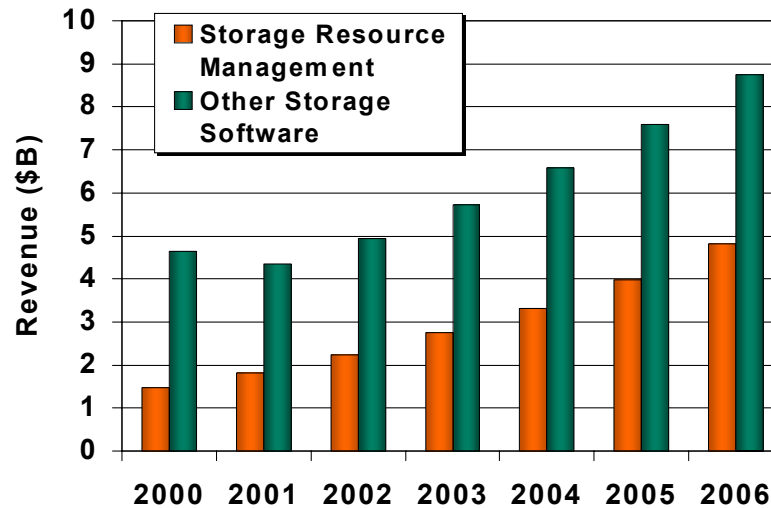
Managing storage can end up “costing six to seven times the purchase price of the storage.”

Aberdeen Group

What is included in administering a storage network?

- **Deployment management** — asset management, change/configuration management, capacity planning
- **Compliance management** — fault monitoring/tracking events, reviews, trend analysis, periodic network snapshots, quota management (end user utilization limits), accounting management (billing and charges sent to users and organizations)
- **Service management** — policy management (define thresholds), storage management (backup, archiving, defining storage hierarchies, and disaster recovery), security management (virus detection, unauthorized access, general user administration)

Storage management software market opportunity



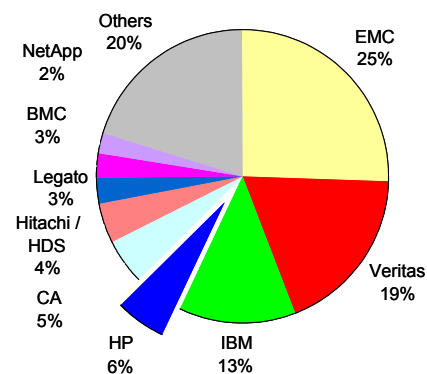
These market trends and customer challenges create the need for storage management tools—a quickly growing market with a large selling potential.

According to IDC's report, *Worldwide Storage Software Forecast and Analysis, 2002-2006*, the storage management software market will grow from \$6.1B USD in 2000 to \$13.6B USD in 2006, which translates to a 14% CAGR. The enterprise storage resource management segment will be the fastest-growing storage software segment with a six-year CAGR of 22%, growing from \$1.47B USD in 2000 to \$4.82B USD in 2006 (source: IDC, June 2002).

Storage management software vendor revenue market

In 2002, HP gained storage management software revenue market share.

- HP became the fourth largest storage management software vendor, according to Gartner.
- While EMC, Veritas, and IBM posted big revenue declines and market share losses, HP was able to maintain its revenue level and gain market share.



Source: Gartner Dataquest – "2002 Storage Management Software Market Share", April 2003

Target customers

Target customers for storage management software can be characterized as enterprise data centers and service providers whose ability to deliver first class storage services influences revenue and customer loyalty. These customers:

- Face planned downtime for storage capacity increases
- Want to increase asset utilization
- Face increased costs due to storage management issues
- Need to maintain service level agreements (SLAs)
- Have storage growth that has outpaced budget and headcount
- Have more than 10TB of storage under management
- Experience more than 80% annual growth in storage
- Manage storage devices from more than one vendor
- Manage direct attached and networked storage
- Interested in managing application-related capacity

HP storage management software

The HP OpenView Storage Area Manager product suite and the HP OpenView Storage Provisioner product, together with availability and access management, and information life cycle management (ILM) applications support the ENSAextended strategy. These applications use rule-based management to automate storage services to provide:

- Easy visualization and management of the storage domain
- End-to-end management tools that consolidate, innovate, and simplify information management
- Software building blocks that help grow infrastructure transparently to meet business needs
- Open APIs and a standards-based approach

HP OpenView SAM business value

Management of storage is now estimated to be 7 times the initial cost of the storage hardware. As a result, there is significant focus on providing customers with the tools needed to proactively and cost effectively manage their storage infrastructure.

SAM enables customers to dramatically reduce total cost of ownership. It provides one tool to manage and monitor a heterogeneous, distributed storage environment, for which it simplifies and automates management tasks. In addition, SAM makes it possible to guarantee the quality of services by enabling customers to manage storage as a service, thus increasing customer satisfaction.

SAM provides customers with the set of tools that allows them to increase efficiency, guarantee highest quality of storage services, and to build a foundation for the future. The following table describes how SAM, coupled with a complete set of HP services and support, provides a comprehensive storage area management software solution.

SAM business value

Operational efficiencies	<ul style="list-style-type: none"> ■ Seamless management from a single management console ■ Integrated service-driven storage management portfolio ■ Central management, monitoring and common reporting structure ■ Consolidated view of storage systems' health, availability, performance, usage, cost, and growth ■ Simplified, automated operations ■ Increased utilization rates
Service levels	<ul style="list-style-type: none"> ■ Maximized storage (service) availability ■ Optimized performance ■ Customized service offering ■ Billing and charge-back ■ Integrated storage service management
Business flexibility	<ul style="list-style-type: none"> ■ Investment protection ■ Extensive multivendor storage device and system support ■ Modular, building-block architecture ■ Support for DAS, NAS, and SAN across both disk and tape ■ Storage service management approach ■ Applications views (Oracle and Exchange) for growth management
Complete service offering	<ul style="list-style-type: none"> ■ SAM consulting services ■ SAM implementation services ■ SAM support services

HP OpenView Storage Area Manager

HP OpenView Storage Area Manager helps IT organizations gain (or regain) control over their storage environment. OpenView SAM provides a uniform, central management console and common reporting structure to centralize and simplify the management of all storage and interconnection devices and resources, including:

- Heterogeneous devices (across multivendor products)
- Network (NAS and SAN) and direct-attached devices (DAS)
- Legacy and new devices
- Distributed devices (across geographies)

Managing both direct-attached and network-attached storage, Storage Area Manager helps customers move storage from a dedicated, direct-attached state, where storage space is unshared and unmanaged, into a network-attached state where storage resources on the network are centrally managed and may be shared. This helps enterprises manage their legacy storage and protect existing storage investments while developing new solutions.

OpenView SAM provides a flexible, building-block approach, allowing customers to acquire only the features they need and to seamlessly add and integrate additional components as needed.

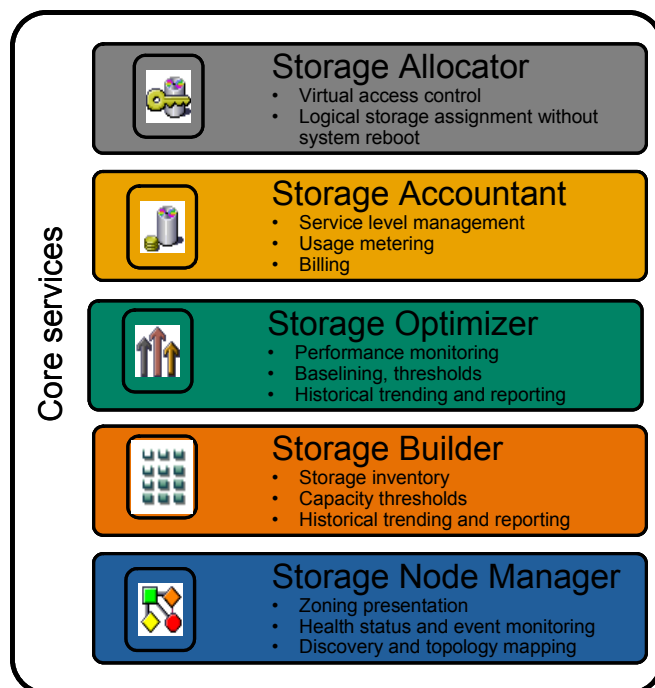
OpenView SAM can help administrators to quickly move beyond business challenges to take control of their entire storage environment. SAM reduces complexity and increases operational and staff efficiency by integrating, centralizing, simplifying, and automating management tasks across distributed, multivendor storage and operating systems.

Components

The Storage Area Manager suite consists of five integrated software applications built on a common architecture referred to as Core Services. The software applications are accessed through a single graphical user interface and share common functionality provided by the Core Services, such as licensing, a central data repository, device discovery, and event management. Core Services functionality is provided whether one application or the complete product suite is installed and/or licensed.

Whether purchased separately or as the complete suite, software applications are delivered and installed from a single CD-ROM. The applications must be licensed in order to be operational.

The following graphic shows how the five SAM components are built on the Core Services common architecture.

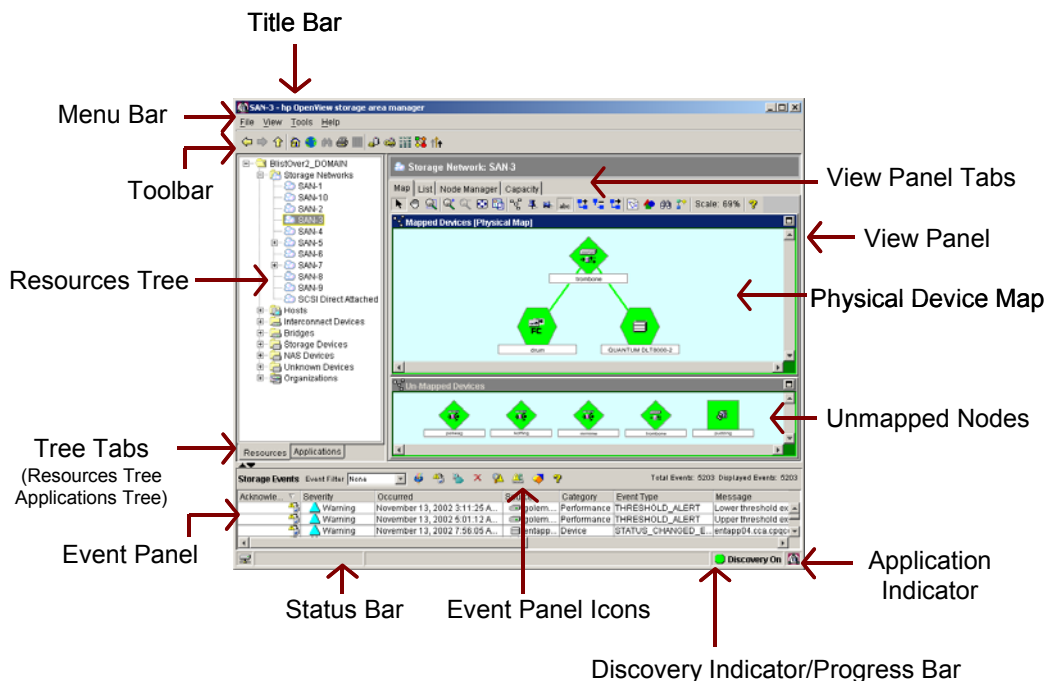


Today, the Storage Area Management software suite includes the following products and capabilities:

1. **LUN storage assignment and access control (Storage Allocator)** — online host-to-LUN (logical unit) assignment and host access control
2. **Storage usage metering and charge-back (Storage Accountant)** — usage metering for financial analysis, budgeting, and charge-back
3. **Performance management (Storage Optimizer)** — Monitoring and performance trending
4. **Capacity management (Storage Builder)** — capacity assessment, inventory, monitoring, and forecasting; also application views for managing Oracle and Exchange
5. **Device management (Storage Node Manager)** — discovery, topology mapping, monitoring of network storage and direct attached storage, disk and tape, old and new devices

Open SAM user interface

The following graphic shows the Storage Area Manager user interface.



Storage Area Manager's user interface allows customers to monitor the status of their storage network, view event information, and easily perform administrative tasks.

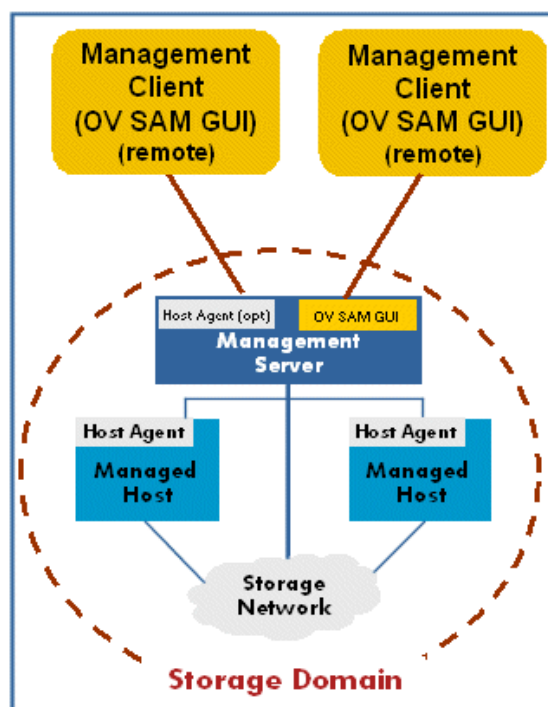
- The *title bar* indicates the node or subnode currently selected in the tree panel and the product name. For example, DOMAIN_NAME – HP OpenView Storage Area Manager.
- The *menu bar* and *toolbar* provide access to commonly performed tasks. Application icons are included on the toolbar, which provide direct navigation to each application's home page.
- The *tree panel* includes two views, resources and applications, which are controlled by the tree panel tabs on the bottom of the tree panel. Each tree panel is discussed later in this module.
- The *event view panel* lists events received and reported by Storage Area Manager as it monitors the storage network.
- The *view panel* displays detailed content for the node or subnode that is currently selected in the tree panel.
- The *application indicator* reflects which application's information is currently displayed in the view panel.
- The *discovery indicator* reflects if Storage Area Manager's ongoing device discovery process is on or off.

Open SAM architecture

The SAM environment includes a management server, one or more clients, and one or more SAN hosts.

- The management server software can be installed on a Windows 2000 server, which now includes the HP OpenView Storage Management Appliance.
- The management client is a Windows 2000, Windows XP, HP-UX, or Sun Solaris console on which the Storage Area Manager user interface is installed. Administrators can access and run Storage Area Manager from the management clients.
- The host agent software is installed on each SAN host to which an interconnect or a storage device is connected. It enables communication with those devices. SAN hosts are currently supported on Windows NT, Windows 2000, HP-UX, Tru64 UNIX, IBM AIX, Sun Solaris, Linux, OpenVMS and NetWare. Other agents will be available in the future.

The following graphic identifies SAM elements within a storage domain.



Management server

The management server is a server application that hosts the majority of Storage Area Manager's functionality. This framework includes the Storage Area Manager's database, discovery system, event-handling subsystem, configuration files, and server components for each of the five products that comprise the product suite.

Management client

The management client is a graphical user interface application that uses a common navigation and presentation framework to display storage information that is stored by the management server. It performs the same activities as the management server. However, the management client does not have a dedicated database.

Managed hosts

Managed hosts include all hosts (with supported operating systems) on the SAN to which storage or interconnect devices are connected. After Storage Area Manager software is installed on the management server, SAM Host Agent software is deployed to hosts within the SAN.

Operating system support

The following table lists operating system support for the SAM components.

SAM architecture component	Operating system
Management server	<ul style="list-style-type: none">■ Microsoft Windows 2000 Professional, Server, Advanced Server (SP3 and SP4)■ HP OpenView Storage Management Appliance II or III with HP OpenView Storage Management Appliance software installed
Management console	<ul style="list-style-type: none">■ HP-UX 11.0, 11.11■ Solaris 8.0■ Microsoft Windows 2000 Professional, Server, Advanced Server (SP3 and SP4)■ Microsoft Windows XP Professional■ Linux Red Hat AS 2.1
SAN host(s)	<ul style="list-style-type: none">■ HP-UX 10.20, 11.0 32-bit, 11.0 64-bit fabric, 11.11 (11i) 64-bit no fabric, and 11.20 (IA64)■ Sun Solaris. 2.6, 7.0, and 8.0■ Red Hat Linux. 7.1 (Kernel 2.4.2)■ Windows 2000 Professional, Server, Advanced Server, and Data Center (SP2)■ Windows NT, Workstation, Server, and Enterprise Server (all SP6a)■ IBM AIX 4.3.3 and 5.1■ Tru64 UNIX 5.1a, 5.1b (except Allocator)■ OpenVMS 7.3 and 7.3-1 (Node Manager, Builder, and Accountant)■ Novell NetWare 6.0 (Node Manager, Builder, & Accountant)
Supported applications	<ul style="list-style-type: none">■ Oracle 8i (8.0, 8.1), 9i (9.0, 9.2) all 32- and 64-bit versions<ul style="list-style-type: none">- HP-UX 11.0, 11.11- Solaris 7.0, 8.0, 9.0- Microsoft Windows 2000 Professional, Server, Advanced Server, and Data Center (SP3)- Microsoft Windows NT Workstation, Server, and Enterprise Server (all SP6a)- Tru64 V4.0F, V5.1A■ Exchange 2000<ul style="list-style-type: none">- Microsoft Windows 2000 Server, Advanced Server

For the most current information on supported operating systems and devices, refer to either of the following:

- SAM QuickSpecs, which is located at:
<http://h18006.www1.hp.com/products/storage/software/sam/specifications.html>
- SPOCK (Single Point of Configuration Knowledge), which is located at:
<http://turbo.rose.hp.com/spock/>

Qualifying questions — SAM

The following is a list of SAM suite-level qualifying questions.

Business executive	IT director/manager
<ul style="list-style-type: none"> ■ Do you need to increase operational efficiency and staff productivity? ■ Do you need to optimize cost? ■ Do you need to manage geographically separated sites from a single location? 	<ul style="list-style-type: none"> ■ How do you manage your storage resources and infrastructure? ■ Do you have a single solution to manage multivendor, direct-attached, and network storage, disk and tape, legacy and new storage? ■ Are you able to provide guaranteed quality of storage services? Do you know what service levels (for example, availability and performance) are required by a specific line of business/customer? Are you able to manage and maintain service level objectives, and what cost is associated with providing that service? ■ Is your storage management system integrated with your enterprise management system (network, system, and application management)?

Storage Allocator — access control and storage assignment

HP OpenView Storage Allocator provides a centralized, uniform mechanism with a convenient drag-and-drop interface to dynamically add, remove, or assign multivendor storage to one or more hosts without system downtime. Storage Allocator allows multivendor storage to be treated as a virtual pool and assigned to any host, ensuring flexibility and increasing utilization rates. Centralized access control ensures that only authorized hosts have access to assigned storage, ensuring data integrity and avoiding data loss.

Storage Allocator controls storage access and provides security by assigning LUNs to specific hosts or share groups. After LUNs are assigned, they cannot be accessed by any other hosts. With this application, customers can assign, unassign, and reassign storage dynamically from a pool of diverse storage devices.

What does it do?	What are its most important features?
Virtualizes the host to storage device access control by providing storage security for storage area networks	Provides a uniform, centralized environment where an administrator can dynamically assign and enforce access control between hosts and storage devices, RAID, JBOD, and tape devices in SAN environments

When to use Storage Allocator

Because Storage Allocator adds the value of a single network view (as opposed to manually configuring thousands of LUNs across hundreds of servers), it is ideal when there is a large number of devices and/or hosts which implies a large number of assignments. It is also appropriate to use Storage Allocator:

- When a customer requires access control for storage devices that do not provide masking (for example, JBOD and/or tape)
- When the environment is dynamic: the customer wants protection from unassignment of storage in use, to remove storage without reboots, and to automatically mount file systems on Windows

Features and benefits

The following table describes Storage Allocator features and benefits.

Features	Benefits
Centralized, unified method for dynamically assigning RAID, JBOD and tape devices in SAN environments	Protects against data loss and unauthorized access by controlling host access to storage devices
LUN level storage assignment: Add/remove/assign storage without host reboots	Optimizes storage utilization by enabling any LUN to be assigned to any host quickly and easily with no downtime rebooting thereby increasing overall system availability
Storage access control: control which hosts can access specific storage devices	Storage security, prevents data loss and unauthorized access
Highly scalable	Simplifies administration since one software solution can be used in a wide range of configurations
Automated storage network discovery	Automatically populates configuration database with host and storage device information, dramatically reduces configuration time and eliminates a major source of errors
Intuitive graphical user interface	Using familiar techniques and powerful controls like view filters maximizes productivity and minimizes training time
Share groups for cluster configurations	Clear visualization of storage accessible to multiple hosts prevents errors when setting up cluster server and shared tape device environments
Fibre Channel topology independence	Compatibility with FC arbitrated loop and switched fabric provides SAN configuration flexibility
Open system, heterogeneous environments	A single tool can be used to provide storage security in data centers with a mixture of Windows NT servers, UNIX servers, and storage from multiple vendors
Native file system and raw disk support	Greatly simplifies process for moving existing storage to SANs, no need to copy data or reformat

Key product differentiators

- A single product allows management consolidation across all levels of the network (host, device, and fabric).
- Integration with HP OpenView products enables enhanced end-to-end data center operability.
- Independent database access enables continued access to all assigned LUNs. As a result, storage can be allocated dynamically, which contributes to business continuity and meeting SLA requirements.

Qualifying questions — Storage Allocator

The following table lists examples of business executive and IT director/manager storage allocator qualifying questions.

Business executive	IT director/manager
<ul style="list-style-type: none">■ Has your company's productivity been affected by storage system downtime?■ Are you experiencing additional expenses due to adding SAN storage?	<ul style="list-style-type: none">■ Are you managing your SAN efficiently?■ Can you add, remove, or move SAN storage automatically from one location?

Storage Accountant — charge management

HP OpenView Storage Accountant measures storage space in organization accounts and reports the associated cost at the end of each month. Accounts belong to internal or external organizations.

Storage Accountant provides a tool set to measure storage service usage for financial analysis, budgeting, and charge-back, which helps control storage costs and increase storage-associated revenues. Automated calculation of storage cost and billing makes it possible to charge for storage services provided. The ability to differentiate storage service offerings helps to better meet customers' demands.

What does it do?	What are its most important features?
Enables enterprise customers and service providers to measure storage assigned to end users for financial analysis, budgeting, and charge-back	Allows storage providers to classify storage offerings into different service levels and manage capacity usage information related to customers

Features and benefits

The following table describes Storage Accountant features and benefits.

Features	Benefits
Create and manage customer accounts and underlying organizations	Provide additional level of measurement within the customer account.
Create and manage service levels and price tiers	Classify and differentiate storage offering based on attributes of storage and services associated with it, such as economy, standard, premium, and calculate the cost associated with the service-tier.
Assign LUNs to service levels and to customer entities or their organizations.	Associate storage with a service-tier and price and map the LUN classified into different service levels according to customers' or their organizations' demands.
Measures and monitors storage usage and consumption	Calculate charges based on usage information.
Calculate charges based on service level price, size of LUNs assigned and duration of storage consumption	Use charges information for financial analysis, budgeting, and charge back.
Generate bills	View charges associated with each customer. Print bills and recover cost associated with providing and assuring storage services.
Generate CSV (comma separated variable), HTML and XML (Extensible Markup Language) output	Integrate usage and charge-related information with third-party reporting, billing, and financial applications.
Usage and billing views	Use data to manage the customer relationship, keep record of usage and answer billing related questions. Modify or create new storage services based on customer usage trends, and perform financial analysis, budgeting or charge back.
Maintain audit log	Keep track of customer, service level, and storage consumption-related events.

Key product differentiators

- Automates the task of tracking costs associated with storage consumption
- Leverages usage information to report the cost or charge associated with usage. The final output is in a currency format rather than a physical capacity format
- Supports multiple vendors, multiple operating systems, DAS, NAS, and SAN

Qualifying questions — Storage Accountant

The following table lists examples of business executive and IT director/manager Storage Accountant qualifying questions.

Business executive	IT director/manager
<ul style="list-style-type: none">■ Can your staff quantify or justify capital expenditures?■ Do you know who is spending the most on storage?■ Can you determine your ROI on storage?	<ul style="list-style-type: none">■ Can you proactively determine whose storage needs is a priority?■ Do you know who is using the majority of your resources from a financial perspective?

Storage Optimizer — performance management

HP OpenView Storage Optimizer enables monitoring and reporting for all storage components in the network. HP OpenView Storage Optimizer monitors the performance of all the storage components on a network and provides all the required information to centrally track storage performance. Baselineing and automatic threshold determination for a wide range of performance metrics for networked storage, including I/O and throughput, allow administrators to proactively tackle performance issues before they impact business operations.

When thresholds are reached, HP OpenView Storage Optimizer alerts administrators to the situation enabling them to act immediately to ensure that storage, and the data that resides on it, stays available. Administrators can use the same process to ensure that performance meets service levels.

What does it do?	What are its most important features?
<ul style="list-style-type: none"> Monitors the performance of the entire storage network including hosts, infrastructure, and storage 	Through the use of simple thresholds, Storage Optimizer alerts storage managers of performance slowdowns before they become major issues

Features and benefits

The following table describes Storage Optimizer features and benefits.

Features	Benefits
Monitors key metrics of SAN performance with the ability to drill down to an individual node level such as host, switch, or storage array.	Act proactively to ensure that service levels are based on SAN performance. In this way, business processes associated with the SAN will always be available.
Centralized performance management across all components of the SAN and across multivendor platforms.	Increase operational and staff efficiency and reduce cost.
Offers several types of access to collected data. For example, a GUI that allows graphing of metrics over time, a CLUI that can manipulate raw or summarized measurements and a set of reports focused on reporting data tabulated over different intervals.	Storage managers will have the information they need to optimize their SAN operation in the form they prefer. Communication of key storage resource trends to upper management will be facilitated through the use of defined reports.
Simple thresholds to be set on performance metric, for example, I/Os per switch port.	Early notification of potential SAN service slowdowns. Proactively ensure that SAN service level expectations are met.
Historical performance metrics of SAN components.	Proactively identify trends and anomalies in the SAN infrastructure, and plan for upgrades. Evaluate the impact of system, storage, and infrastructure upgrades to improve efficiency.

Key product differentiators

- One of the few products on the market that monitors all the components of a storage network environment, including hosts, storage devices, and interconnect devices (host, device, and fabric).
- Integration with broader OpenView products enables end-to-end data center solution

Qualifying questions — Storage Optimizer

The following table lists examples of business executive and IT director/manager Storage Optimizer qualifying questions.

Business executive	IT director/manager
<ul style="list-style-type: none">■ Is SAN performance affecting your revenue or costs?■ Will identifying bottlenecks on your SAN increase your customer's satisfaction?	<ul style="list-style-type: none">■ Do you want to monitor SAN performance?■ Would the ability to set thresholds and identify bottlenecks on the SAN increase service levels?

Storage Builder — capacity management

HP OpenView Storage Builder monitors and reports storage capacity in a storage network. It routinely discovers the physical capacity of storage devices and the logical capacity of hosts and NAS devices, and analyzes the information for current usage, past and future usage trends, and threshold notification.

Storage Builder provides comprehensive inventory management and enables administrators to easily identify and locate free or inefficiently used storage to increase overall utilization rates. Automated capacity thresholds provide early warning of potential capacity shortfalls, enabling administrators to allocate additional storage before a customer's business is affected. Historical trending and future extrapolation help reliably predict future storage demands. Just-in-time capacity acquisition avoids potential service-level agreement (SLA) penalties and downtime.

What does it do?	What are its most important features?
<ul style="list-style-type: none"> Enables enterprise customers and service providers to monitor storage capacity throughout a diverse set of environments 	Allows viewing, monitoring and exporting of storage capacity information, via tables, reports, and graphs, for analysis and planning

Features and benefits

The following table describes Storage Builder features and benefits.

Features	Benefits
Centralized, common view (through screens and reports) of allocated vs. unallocated storage by host, device, and user.	Gain an understanding of how much storage resources are assigned and how much storage is available for deployment. As a result, storage resources will be better utilized, lowering total cost of ownership.
Centralized, common view (through screens and reports) of used vs. unused storage by host, device, and user.	<ul style="list-style-type: none"> Gain an understanding of how much allocated storage capacity has been used. This helps to balance the load across systems and optimize the addition of new users, applications, and data. Gain an understanding what hosts, LUNs, partitions, volumes, or directories are at critical-free space levels and in need of resizing. As a result, storage resource will be better utilized, lowering total cost of ownership.
Threshold-based warning and notification systems for hosts, partitions, volumes, directories, and users.	Early warning of capacity shortfalls that could cause system outages or user inconvenience. Capacity quotas on a per-user basis can be established and monitored to ensure that storage growth is in line with company goals.
Grouping of partitions, volumes, directory, or users to reflect lines of business, departments, or physical locations. Screens, reports, and thresholds can be created for these storage groups.	Gain an understanding who the major users are, and establish consumption norms and quotas.

Features	Benefits
Screens and reports that rank hosts by the amount of storage accessed each day.	The hosts with the most storage accessed over time would be ideal candidates for nodes on a storage area network, resulting in better asset utilization, higher availability, and centralized management.
Historical trending of storage capacity data through screens and reports, and extrapolation of storage capacity data into the future.	<ul style="list-style-type: none"> ■ Make storage demand and growth more predictable. Gain an understanding of potential shortfalls and plan for just-in-time purchases of additional storage capacity. ■ Utilize historical and extrapolated data to justify decisions and gain support from upper management.
Tabular and graphic reports showing allocated vs. unallocated storage as well as consumed vs. free storage. Almost all reports are available on a host, storage device, LUN, volume, directory, and user (file) level.	Facts, trends, and analysis concerning an organization's storage resources can be communicated effectively to staff and upper management.
Applications views for Oracle and Exchange	Monitoring, managing and planning for growth of Oracle and Exchange databases

Key product differentiators

- Offers a centralized view of storage allocation and usage by host, device, and user
- Supports multiple vendors, multiple operating systems, DAS, NAS, SAN, disk and tape drives
- Sends annotated events to OpenView Operations

Qualifying questions — Storage Builder

The following table lists examples of business executive and IT director/manager Storage Builder qualifying questions.

Business executive	IT director/manager
<ul style="list-style-type: none"> ■ Do you need to increase storage capacity to increase revenues? ■ Can you decrease costs by freeing up valuable storage space? ■ Are you optimizing expenditures for storage? 	<ul style="list-style-type: none"> ■ Do you want to monitor storage allocation and usage? ■ Can you forecast storage capacity? ■ Do you know how much you will need to spend in the future? ■ Are you running Oracle or Exchange databases and want to better manage their growth?

Storage Node Manager — device management

HP OpenView Storage Node Manager provides a central management console and launch platform to manage, monitor, and troubleshoot all storage resources across the distributed enterprise. Automated device discovery and customizable topology mapping provide a graphical view of storage devices and their physical and redundant connections, including zone representation. Continuous event monitoring and status information enable administrators to quickly identify, isolate, and resolve bottlenecks that jeopardize a network storage systems' health.

What does it do?	What are its most important features?
Provides a central management console from which multivendor storage resources can be discovered, mapped, and configured	Continually monitors storage resources to discover recent additions/subtractions and provides a central launch point for device applications

Features and benefits

The following table describes Storage Node Manager features and benefits.

Features	Benefits
Centralized management console	Operators no longer need to run from device to device to troubleshoot problems. Adding, deleting, or changing storage configurations and tracking data center environment changes are handled through a single interface.
Status and event monitoring	Proactive and quick problem isolation through visible alerts and alarms that display the health of each device (event logs maintained for review at any time).
Auto-discovery of devices	Maximized availability as changes in the storage network are immediately identified and mapped through continual automatic discovery.
Device applications	Reduced configuration and troubleshooting time by launching device applications directly from the management station.
Graphical device maps	Easy-to-interpret visual status of all aspects of the storage network, including redundant connections between devices.
Device icons	Efficient management through a standard set of icons.
Asset management	Customizable location fields allow system administrators to easily identify physical location of devices in large, distributed (for example, campus) environments.

Key product differentiators

- Central management console from which multivendor storage and infrastructure resources can be centrally and automatically discovered, mapped, monitored, configured, and maintained
- Common launch point for device applications

Qualifying questions — Storage Node Manager

The following table lists examples of business executive and IT director/manager Storage Node Manager qualifying questions.

Business executive	IT director/manager
<ul style="list-style-type: none">■ Do you need to increase customer satisfaction by increasing your performance on Service Level Objectives (SLOs)?■ Do you need to decrease your IT budget by optimizing staff?	<ul style="list-style-type: none">■ Are you reacting to storage problems instead of planning for storage problems?■ Are you mapping your storage environment manually?

OpenView SAM supported device types

HP OpenView SAM supports the following device types:

- Hosts (Windows NT, Windows 2000, HP-UX, Sun Solaris, and Red Hat Linux, IBM AIX, Tru64 UNIX)
- Fibre Channel hubs
- Fibre Channel switches
- Fibre Channel/SCSI bridges
- JBODs
 - SCSI (only JBODs)
 - Fibre Channel (enclosure only)
- Disk arrays (SCSI, Fibre Channel)
- Tape libraries
 - SCSI (DLT)
 - Fibre Channel
- NAS disk array

Supported disk and tape storage, interconnect devices

For the most current information on supported operating systems and devices, refer to either of the following:

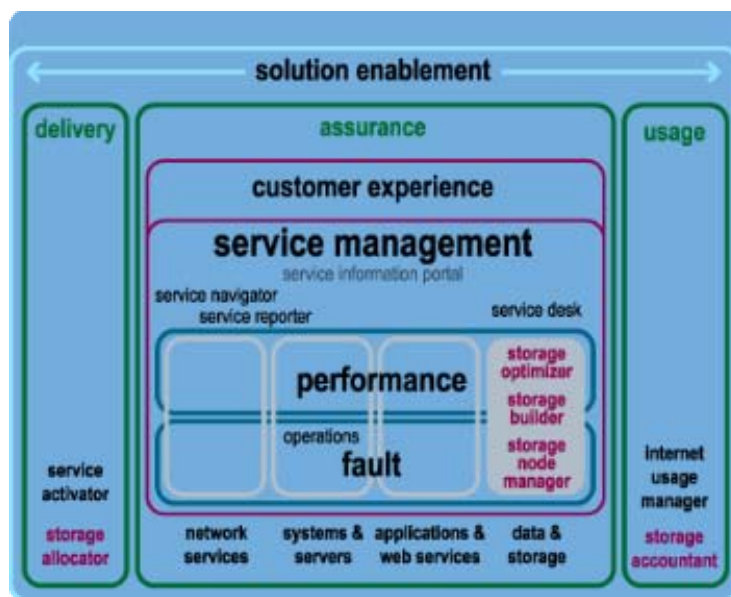
- SAM QuickSpecs, which is located at:
<http://h18006.www1.hp.com/products/storage/software/sam/specifications.html>
- SPOCK (Single Point of Configuration Knowledge), which is located at:
<http://turbo.rose.hp.com/spock/>

Enhanced integration with OpenView

HP OpenView SAM is part of the comprehensive, integrated HP OpenView enterprise/service management solution. HP OpenView provides the most complete end-to-end, multi-platform management solutions, with a flexible, solution-ready architecture that integrates readily with third-party software, internal software (using HP OpenView smart plug-ins (SPIs) technology), and industry-standard integration buses. HP OpenView spans the following infrastructure components:

- Network services
- Systems and servers
- Applications and web services
- Data and storage
- Cross-infrastructure fault and performance management components

The following graphic shows the HP OpenView product family building blocks in greater detail, including the OpenView enterprise management products as well as the integrated OpenView Storage Area Management products. This building block approach allows customers to transparently build and grow an end-to-end enterprise management system.



All infrastructure components integrate with HP OpenView's service management solutions, aligning infrastructure services with the overall business objectives, and integrating them into the overall service level management system. An integrated service management system allows customers to manage and measure overall IT service delivery and meet service-level objectives, thus ensuring the best customer experience.

As customer needs grow and change, products can be added. The following HP OpenView components integrate with SAM and provide additional customer business value:

- OpenView Operations
- OpenView Service Navigator
- OpenView Service Reporter
- OpenView Service Desk
- Internet Usage Manager

OpenView integration benefits

The integration of Storage Area Manager into OpenView provides the following benefits:

- It increases efficiency. A “single pane of glass” across all systems provides close and efficient control of events happening across all systems, creating a “mission control” center for the entire distributed environment.
- Administrators can monitor, control, and report on the health of enterprise storage along with other network elements, thereby improving uptime.
- Administrators can filter and correlate processes and respond to thousands of events that occur daily at the highest level of management.

SANworks upgrade program

Starting in May 2003, NSS will launch an upgrade program for customers who purchased SANworks products that are now being discontinued as a result of the HP-Compaq merger. Customers who previously purchased the SANworks products listed below will receive a no-charge software upgrade to the comparable OpenView Storage Area Manager component.

The following table lists Compaq SANworks storage management software qualifying for an upgrade to OpenView SAM with its corresponding OpenView SAM replacement product.

Product	HP OpenView SAM component
HP SANworks Storage Resource Manager V4.0x	HP OpenView Storage Builder
HP SANworks Storage Allocation Reporter V1.x	HP OpenView Storage Accountant
HP StorageWorks Network View V2.x	HP OpenView Storage Node Manager HP OpenView Storage Optimizer

HP OpenView Storage Provisioner

■ Features

- Provides multiple storage utilities, or services, based on service levels and storage attributes
- Provides system administrators and database administrators with self-service access to acquire storage as needed for their applications
- Creates usage reports to support billing for both storage providers and storage users
- Will be integrated into OpenView SAM architecture

■ Benefits

- Increases administration efficiency by automating and simplifying storage provisioning tasks
- Improves user satisfaction by meeting or exceeding service level agreements
- Increases uptime and reduces errors

Note

HP OpenView Storage Provisioner currently runs on the management appliance. It will be integrated into OpenView Storage Area Manager in Version 4.0. This will allow customers to manage functions such as provisioning, capacity management, performance management, device management, and cost management from a single tool. This single tool will have a single host agent and common repository, thus reducing the complexity of the storage management environment.

Compatibility between Storage Allocator and Storage Provisioner

Storage Allocator's main focus is to provide host-based, logical unit (LUN) security management for the SAN. It provides the ability to allocate and de-allocate storage to or from a host.

Storage Provisioner is an automated **provisioning** application that uses array-based LUN management and significantly reduces the amount of time it takes to provision storage. This software manages both HSG80- and HSV110-based storage subsystems and runs on the storage management appliance.

Storage Provisioner allows storage providers to

- Manage storage as a utility
- Customize service levels
- Grant consumers self-service access to storage by using quotas

Storage Provisioner also creates usage reports to support billing for both storage providers and consumers.

It is possible to have both of these products installed on the Storage Management Appliance with no technical problems. However, if both products are used simultaneously, conflicts and data corruption can occur if they attempt to allocate the same storage.

For example, a LUN can be assigned to a host using Storage Allocator. However, if Storage Provisioner is then used, the LUN appears to be available and Storage Provisioner could reassign the same LUN, causing information to be overwritten.

HP recommends, as a best practice, that customers use **either** Storage Allocator or Storage Provisioner, **but not both**, for storage provisioning. If a customer chooses to use both, the customer must ensure that the two applications do not attempt to manage the same host and storage resource. Otherwise, data corruption can occur.

In OpenView SAM 4.0, the Allocator and Provisioner products will be combined into a single provisioning tool, eliminating any potential conflict.

Who to call on when selling SAM

The following section describes the HP OpenView SAM customer profile and target industries.

Target customer contacts

- CIO
- Director of IT/data center manager
- Storage manager or specific storage IT staff
- Line of business manager

Most sales representatives are comfortable selling technical features and benefits to IT organizations, but storage also directly affects the line of business. In some organizations, the IT department could be removed from the real business problems that the organization faces.

Therefore, by calling on the line of business managers, you will gain perspectives on the whole company that will allow you to strengthen your relationship and ensure that the business needs of the organization are being met. This information, in turn, will enhance your conversations with business executives.

Summary

- Storage resource management is a rapidly growing market with a large selling potential.
- HP OpenView SAM:
 - Target customers: data centers and service providers whose revenue and customer loyalty depend on first-class storage services
 - Business value: offers increased storage management efficiency, guaranteed quality of service, scalability and flexibility, and HP trusted advice and services.
 - Five components:
 - ◆ HP OpenView Storage Allocator (LUN assignment/access)
 - ◆ HP OpenView Storage Accountant (usage metering/chargeback)
 - ◆ HP OpenView Storage Optimizer (performance management)
 - ◆ HP OpenView Storage Builder (capacity management)
 - ◆ HP OpenView Storage Node Manager (device discovery/monitoring)
 - Integration with OpenView allows a single window to control and monitor both storage and systems
- HP OpenView Storage Provisioner:
 - Automates the process of provisioning storage to:
 - ◆ Create multiple storage offerings
 - ◆ Provide end user self-service access
 - ◆ Automate billing
 - Will be integrated into OpenView SAM 4.0

Learning check

1. Which of the following best describes how IT managers often overestimate their storage array utilization rates?
 - a. Assume 70% rates when they are actually closer to 40–50%
 - b. Assume 80% rates when they are actually closer to 40–50%
 - c. Assume 80% rates when they are actually closer to 65%
 - d. Assume 65% rates when they are actually closer to 75–85%
2. Match the letter of the SAM business value to the corresponding description in the table below.

A. Operational efficiency	B. Service levels
C. Business flexibility	D. Complete service offering
Billing and charge-back	
Increased utilization rates	
Modular, building-block architecture	
SAM support services	
3. Which of the following most accurately describes where the SAM management software is installed?
 - a. HP-UX server
 - b. Windows 2000 or HP-UX server
 - c. Windows 2000 server
 - d. Windows 2000 server, or HP OpenView storage management appliance
4. Which of the following is not an appropriate qualifying question to identify a SAM requirement?
 - a. How do you manage your storage resources and infrastructure?
 - b. Do you have a single solution to manage multivendor, direct-attached and network storage, disk and tape, legacy and new storage?
 - c. Do you need to optimize cost?
 - d. Do you want to consolidate your direct-attach storage into a network-attached storage solution?

5. Which of the following SAM components tracks the costs associated with storage consumption?
 - a. Storage Allocator
 - b. Storage Accountant
 - c. Storage Optimizer
 - d. Storage Node Manager
6. HP recommends that you use which of the following for storage provisioning?
 - a. Storage Provisioner
 - b. Storage Allocator
 - c. Storage Builder
 - d. Either Storage Provisioner or Storage Allocator

HP OpenView Storage Data Protector and HP Storage Media Operations

Module 15

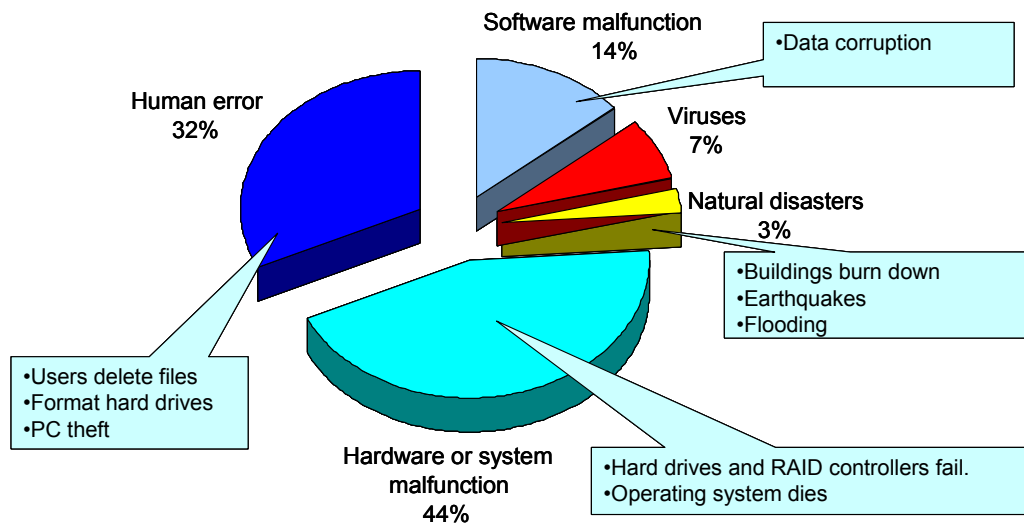
Objectives

After completing this module, students should be able to:

- Identify business needs and target customer characteristics for backup and recovery software, and media management software
- Describe the business value proposition of HP OpenView Storage Data Protector backup and recovery software and HP StorageWorks Storage Media Operations media management software
- Describe the features and benefits of Data Protector and Storage Media Operations
- Use appropriate questions to qualify opportunities in the backup and recovery software and media management target markets
- Describe how Data Protector and Storage Media Operations work together

How is data lost?

Customers may need a reminder about the importance of backing up their data.



Source: Understanding Data Loss. CBL Data Recovery Technologies Inc. Industry Data Recovery Report

Customer business needs

There are several needs for storage backup in the enterprise class market including:

- **Data protection and management** — Backup is copying files or databases so that they will be preserved in case of equipment failure or other catastrophe. The traditional backup infrastructure has included both backup applications and tape libraries. The backup applications manage and control both the backup process and the tape and tape automation hardware. The trend now is to contribute to business continuity with faster and more reliable recovery times.
- **Consolidation of backup resources** — Customers improve utilization and reduce management overhead by automating more backup processes and sharing tape libraries on the network between servers.
- **Business continuity** — Refers to the overall IT plan to keep business operations running in any event, planned or unplanned. Improved uptime and faster recovery from disk failures improves time-to-market and increases user productivity.
- **Storage interoperability** — Enabling the sharing of data from different operating systems on the same storage libraries.

Customer characteristics

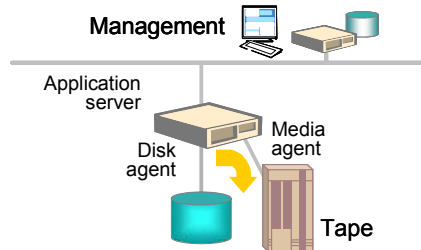
Look for customers who have:

- Reduced or eliminated backup windows
 - Customers are saying that backup windows are shrinking.
 - Users are complaining of backed-up traffic on the network.
- Zero tolerance for downtime
 - Customers are saying that they cannot afford time to back up information.
- Policy-driven data protection requirements
 - Customers are saying that their storage environment is no longer cost-effective and is draining IT.
- Standardized data archive formats
 - Customer needs to consolidate primary and secondary storage.
- A need for a single source of support
 - Customers expect a higher level of support from a single source.

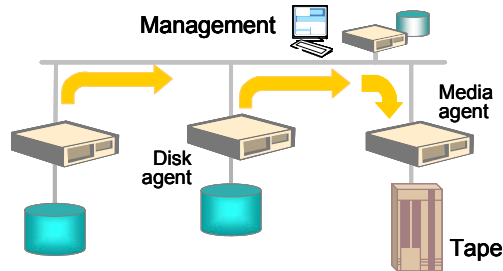
Direct backup and network-based backup

Customers may use several backup software vendors throughout an enterprise and deploy different backup methods depending on their business needs, staffing or budget restraints. At some point management consolidation may become a priority. HP OpenView Storage Data Protector supports direct, network-based (LAN) and SAN-based backup solutions.

Local protection



Network-based protection



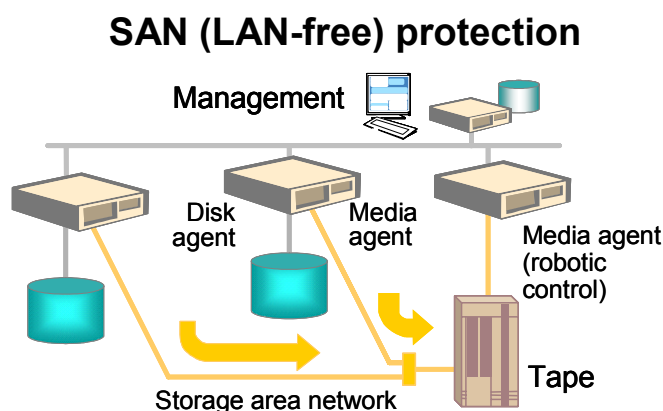
Assessing customer need for data protection

Customers may be in need of assistance to assess how their backup strategies fit within their evolving business needs and overall IT plans.

- Remote departments within a company may be concerned about over-investment in multiple dedicated tape drives, which is costly and time-consuming to manage.
- System managers running a centralized LAN-based backup may be facing shrinking backup windows that make it impossible to satisfy users or users who may be complaining of congestion on the network due to backups.
- Senior management may have done a business assessment of IT and determined that the storage environment is no longer cost-effective and is draining IT.
- System managers may be interested in a tool that can manage multiple arrays and application environments.

SAN backup

Most enterprise customers today are using SAN-based tape backup in some areas of the business.



Enterprise Backup Solution with Data Protector and third-party ISVs

Enterprise Backup Solution (EBS) for heterogeneous SANs provides customers with the option of configuring a backup solution using any of several leading backup software solutions, allowing LTO, SDLT, DLT, or AIT libraries to be consolidated with the HP storage subsystems on the same SAN.

HP supports the following software backup solutions:

- HP OpenView Storage Data Protector
- Atempo Time Navigator
- BackBone NetVault
- CA BrightStor ARCserve
- CommVault Galaxy
- Legato NetWorker
- Veritas Backup Exec
- Veritas NetBackup
- Tivoli Storage Manager

When to Sell HP OpenView Storage Data Protector

Look for Data Protector opportunities when customers are:

- Unhappy with current vendor
 - Out-grown backup infrastructure
 - Licensing too expensive
 - Vendor facing financial problems
 - Want sole vendor
- Consolidating backup across operating systems and organization
 - Lower overall TCO for backup
 - Need enterprise capabilities
- Migrating from DAS to SAN tape
 - Sharing library resources
 - Other vendors charge for SAN licenses (like a buying a new application), which forces evaluation

HP OpenView Storage Data Protector value proposition

Data Protector delivers new levels of recovery using a service-driven management approach.

- Data Protector is the only tool that integrates disk-based and tape-based recovery in a single product across multiple applications, operating systems, and storage architectures.
- Data Protector is unique in managing data protection as an integral component of an overall IT service, with increased staff efficiency.

Data Protector methods

Data Protector gives administrators a choice of backup options depending on the business need for a specific application.

- Tape-only protection
- Disk-only protection
- Combinations of disk and tape backup

After it is configured, Data Protector fully automates the continuous protection process, including rotation of mirrors. For recovery, the administrator selects the specific recovery image from the GUI.

Tape backup

Data protection has traditionally consisted of backing up information from disk to tape. Traditional tape backup relies on a recovery model that assumes, in the event of corruption or loss of the production data, that a tape copy made the night before could restore the data. In the case of transaction systems, logs could then be replayed to restore the information to the point just prior to the data loss.

In this backup-oriented world, a lot of attention is focused on:

- How the backups occur
- Unique configurations to minimize the network or server impact of the backup process
- The finer points of incremental backups and tape consumption

Many of the traditional software products even have “backup” as part of their name: NetBackup, Backup Exec, and OmniBack.

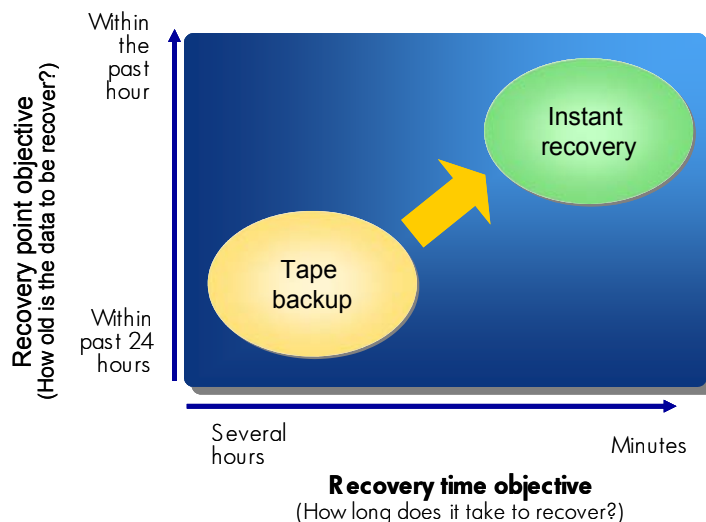
Shifting focus from backup to recovery

The traditional backup model has become unwieldy as the volume of data has grown dramatically and tape backup recovery times have grown in proportion to the increasing size of datasets. Even considering the best tape-recovery speeds of perhaps a terabyte-per-hour (a recent industry benchmark), it can take from several hours to days to restore large multi-terabyte environments. With today’s increasing emphasis on mission-critical systems—from messaging to resource planning, to online web presence—application downtime for any reason has become increasingly unacceptable.

To measure the quality of data recovery strategies, two metrics have emerged:

- Recovery time objective or “how long does it take to recover?”
- Recovery point objective or “how old is the data to which I recover?”

When measured against these metrics, traditional tape backup—particularly for large datasets in mission-critical environments—no longer meets the business need.



Complementary disk and tape backup

Disk-based backup/restore solutions are complementary to tape. Because of the random access nature of disk-based solutions it can provide value by offloading the daily incremental backup requirements from tape and providing a very fast single file restore capability. Tape solutions would then be used to provide weekly, monthly, and quarterly backups and/or long-term archival for onsite and offsite storage.

Finally, tape solutions continue to provide a storage solution with removable media. Many companies require data to be stored off-site where corruption or loss of data is minimized. Tape continues to provide an affordable mechanism to meet this challenge. This is complemented by the long shelf-life characteristics of tape that can be stored up to 30 years. Disk media is limited to a 5 to 7 year shelf life (disk life can be even shorter when disk drives are in use).

Consider...	For...
Disk-based backup	<ul style="list-style-type: none"> ■ Daily incremental backups ■ Fast single-file restore capability
Tape-based backup	<ul style="list-style-type: none"> ■ Weekly, monthly and quarterly backups ■ Removable media with long shelf life ■ Long-term on-site and off-site archival

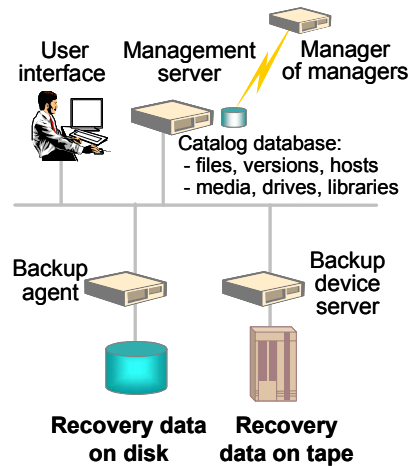
Integration of disk- and tape-based recovery

HP OpenView Storage Data Protector is the first backup software management tool to integrate disk- and tape-based recovery in a single product across multiple applications, operating systems, and storage architectures.

Local to enterprise protection

- Automates routine tasks to maximize the effectiveness of data protection staff
- Ensures recovery from any potential disruption, from instant recovery through system or site disaster recovery
- Scalable from single server to enterprise, across applications, operating environments, storage, and protection approaches

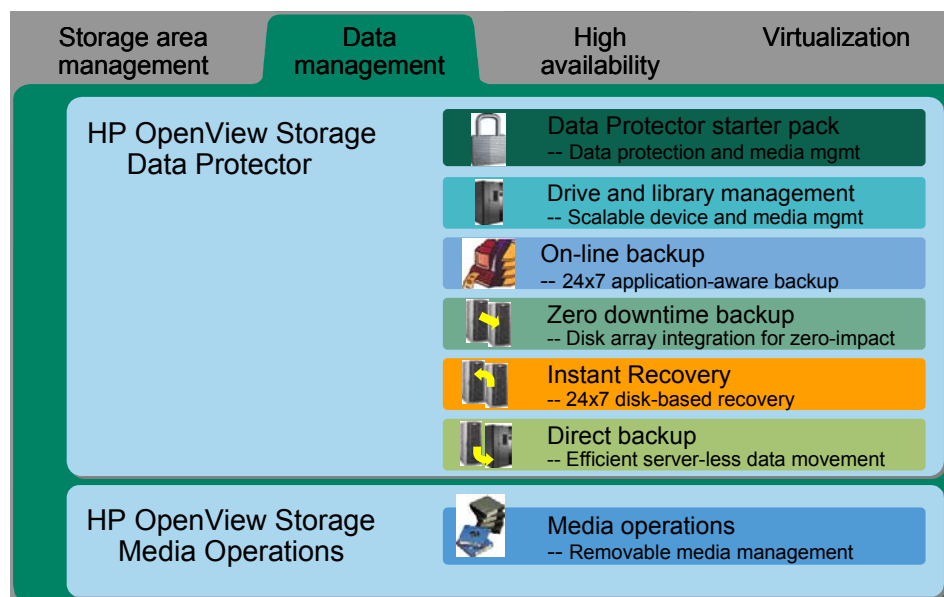
Distributed architecture with centralized control



HP OpenView Storage Data Protector

The HP OpenView Storage Data Protector software provides enterprise data protection and disaster recovery, ensuring recovery from any disruption. Data Protector integrates a variety of techniques to eliminate backup and recovery windows. The capabilities to eliminate planned downtime range from online backup and backup of open files to zero downtime, zero-impact backup. The software provides industry-leading instant recovery as well as several disaster recovery alternatives to eliminate unplanned downtime, allowing recovery of entire data centers in minutes.

Data Protector enables organizations to reduce costs by automating routine tasks to maximize the effectiveness of the data protection staff. For the price of an entry-level product, Data Protector provides the enterprise functionality that customers need. Data Protector scales from single server to distributed enterprise, covering an extensive range of heterogeneous applications, operating environments, and storage configurations with a single solution.



New features

- Increased resilience with recovery from any disruption, from instant recovery to site or system disaster recovery
- Eliminates backup windows for HP StorageWorks EVA customers with the industry's first fully-integrated out-of-the-box Zero-Downtime Backup solution for the HP StorageWorks EVA array
- Eliminates recovery windows for EVA customers by integrating the EVA Instant Recovery capability to enable the recovery of even terabytes of application data in minutes, not the hours it would take to restore this data from tape
- Supports the following Microsoft features:
 - Incorporates the latest Microsoft Windows Server 2003 backup features into customer's environments
 - Fully integrates Microsoft's Volume Shadow Copy Service to streamline backup of open files, databases and applications
 - Incorporates support for Microsoft's Automated System Recovery
- Enables zero performance degradation of the production environment by supporting zero downtime backup for Microsoft Exchange 2003 with Volume Shadow Copy Services' transportable snapshots
- Reduces performance impact on backup servers by efficient use of infrastructure (direct device to device data copies)
- Uses Zero Downtime Backup for maximum application server productivity and can recover terabytes in minutes using Instant Recovery
- Expands the coverage of its unique disk-image delivery recovery approach to now include AIX and Tru64 UNIX environments, to recover complete systems with minimal administrator time
- Simplifies preparations for offsite disaster recovery by enabling automated media copy as part of the protection process
- Supports Microsoft 2- to 8-node Cluster Server including the network load balancing (NLB) to increase availability of application running on Windows Server 2003
- Improves the availability of data through support of multi-pathing software (HP StorageWorks Secure Path, HP StorageWorks Auto Path, EMC PowerPath) to eliminate single point of failure of SAN components
- Improves the zero downtime backup for SQL Server 2000 by allowing restore of SQL Server database to a point in time of failure

Licensing

The Data Protector product structure is based on performance. The more drive licenses that are installed, the more tape drives can be used for backup in parallel, thus the faster the backup will be performed. The product structure is modular and offers significant flexibility. Customers can order the license that provides the Data Protector functionality that best meets the specific requirements of their environment. The Data Protector product structure and licensing consists of three main categories:

- **The base Cell Manager product** — The Cell Manager is supported on HP-UX, Windows, and Solaris. With the Cell Manager system, customers start a cell configuration with the single drive starter pack, which is required once as the initial starting point.
- **Additional tape drive licenses** — Referred to as drive extensions for one concurrently used backup drive.
- **Data Protector functional extensions** — The functional extensions licenses are required once per instance (system, library, and terabyte) for on-line backup of databases and applications, the manager-of-managers functionality, for libraries with more than 60 media slots, for open file backup, direct backup, Instant Recovery, NDMP, and zero downtime backup.

Starter packs

Data Protector starter packs are required once for base configurations. The license to use in the starter pack is for:

- One management system (starter pack) on the specified platform
- One backup drive license
- Unlimited number of backup agents (clients) on any platform
- Built-in media management
- Libraries up to 60 slots (including robotic control)
- The capability to share tape libraries between multiple systems
- Windows disaster recovery options
- Sophisticated reporting (in Data Protector GUI and from the Web)
- Cluster support
- SAN support (with Cell Manager for HP-UX, Sun Solaris)
- Service-centric management through integrations into OpenView

Additional licenses are required for additional drives or data management functions.

Drive and library management

Customers can choose from several required options for licensing additional backup drives directly attached to a UNIX system, a NAS device, used in a SAN or used for serverless backup.

On-line backup extension

Includes the License-to-use to perform on-line backup of databases and applications running on the specified platform:

- Required per server, it does not matter how many databases are running on the system. Even if databases of different types are running on the same system, only one license is required.
- In a cluster environment, each system participating in the cluster requires a License-to-use. Only in case of failover (active/stand by), just one LTU is required. In case of load sharing (active/active), each system requires an LTU.
- With Data Protector 5.1 and higher on-line backup is required for zero downtime backup of databases.

Zero Downtime Backup extension

- For HP StorageWorks Disk Array XP
- For HP StorageWorks Enterprise Virtual Array, Virtual Array
- For EMC Symmetrix

Includes the license-to-use (LTU) for 1TB of used disk space capacity of the specified disk array protected by Zero Downtime Backup (ZDB), using one of the following:

- HP Business Copy XP/EVA/VA and/or HP Continuous Access XP
- EMC TimeFinder and/or EMC SRDF

Used disk space capacity is the total capacity of all primary volumes on the disk array that are used for Zero Downtime Backup or Instant Recovery (primary means the original production data volumes). This amount represents the total true usable capacity of these volumes, corresponding with their configured LDEV sizes. Data Protector does not require licenses for the capacity consumed by the secondary volumes, mirrors, and snapshots that are used for protection.

Instant Recovery extension

- For HP StorageWorks Disk Array XP
- For HP StorageWorks Enterprise Virtual Array

Includes the license-to-use for 1TB of used disk space capacity, required for the instant recovery of the specified disk array using Instant Recovery. Data Protector Instant Recovery permits recovery of terabytes of data from one or multiple recovery disks in minutes; rather than recovery from tape, which could take hours.

Used disk space capacity is the total capacity of all primary volumes on the disk array that are used for Zero Downtime Backup or Instant Recovery (primary means the original production data volumes). This amount represents the total true usable capacity of these volumes, corresponding with their configured LDEV sizes. Data Protector does not require licenses for the capacity consumed by the secondary volumes, mirrors, and snapshots that are used for protection.

Direct backup

- For HP StorageWorks Disk Array XP

Includes the license-to-use to perform direct backup with HP StorageWorks disk array XP. Required once for each terabyte of used source disk space needed for direct (serverless) backup.

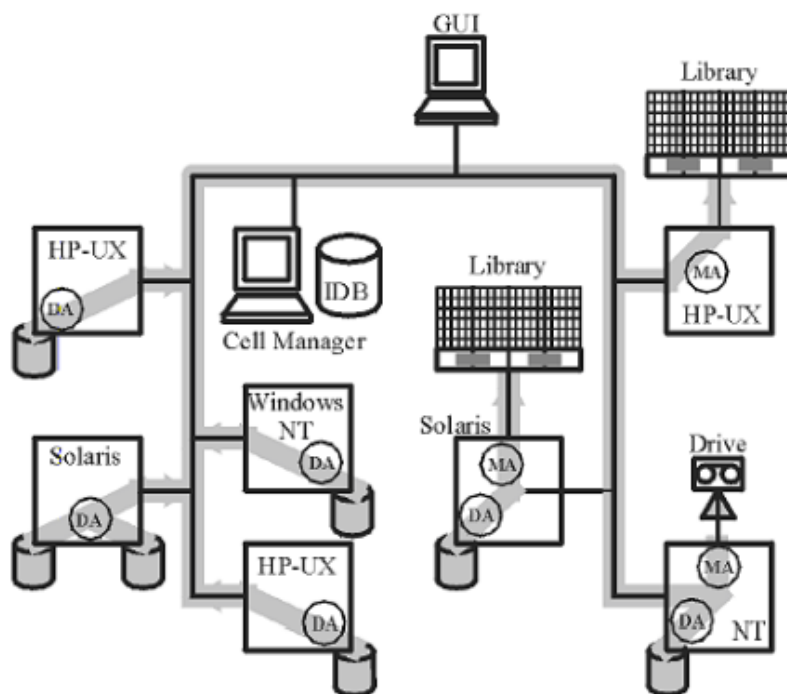
Direct backup using NDMP

This option includes the license-to-use to back up a maximum of 1TB of one NDMP server. Required once per terabyte of used disk space for each filer being backed up by NDMP (for example, HP StorageWorks NAS, Network Appliance Filers, or EMC Celerra file servers).

Used disk space capacity is the total capacity of all volumes of the filer being backed up by NDMP. This amount represents the total usable capacity of these volumes, matching with their configured LDEV sizes.

Data Protector cell architecture and components

The Data Protector cell, shown in the following figure, is a network environment that has a Cell Manager, client systems, and devices. The Cell Manager is the central control point where Data Protector software is installed. After installing Data Protector software, customers can add systems to be backed up. These systems become Data Protector client systems that are part of the cell. When Data Protector backs up files, it saves them to media in backup devices.



Component	Description
MA	Client systems with connected backup devices must have the Data Protector Media Agent (MA) installed.
DA	Client systems you want to back up must have the Data Protector Disk Agent (DA), also called Backup Agent, installed.
IDB	The Data Protector internal database (IDB) keeps track of the files you back up so that you can browse and easily recover the entire system or single files.

Data Protector facilitates backup and restore jobs. Customers can do an immediate (or interactive) backup using the Data Protector user interface or they can schedule backups to run unattended.

Management platforms

The GUI and the Cell Manager systems can run on HP-UX, Solaris Windows NT, Windows 2000, or Windows XP operating systems; they do not have to run the same operating system.

Cell Manager

The Cell Manager is the main system in the cell.

- Manages the cell from a central point
- Contains the IDB, which stores details about backup duration, media identification, and session identification
- Runs the core Data Protector software
- Runs session managers that start and stop backup and restore sessions and write session information to the IDB

Systems to be backed up

Client systems to back up must have the Data Protector Disk Agent, also called Backup Agent, installed.

The DA reads or writes data from a disk on the system and sends or receives data from the Media Agent. The DA is also installed on the Cell Manager, providing backup data on the Cell Manager, the Data Protector configuration, and the IDB.

Systems with a user interface

Data Protector can be managed from any system on the network that has the Data Protector GUI installed. This means that the Cell Manager system can be in a computer room while Data Protector is managed from a desktop system.

Installation server

The installation server holds a repository of the Data Protector software packages for a specific architecture. The Cell Manager is, by default, also an installation server. At least two installation servers are needed for mixed environments: one for UNIX systems and one for Windows systems.

Backup and restore sessions

The Data Protector Cell Manager controls backup and restore sessions, which perform all the required actions for a backup or restore.

What is a backup session?

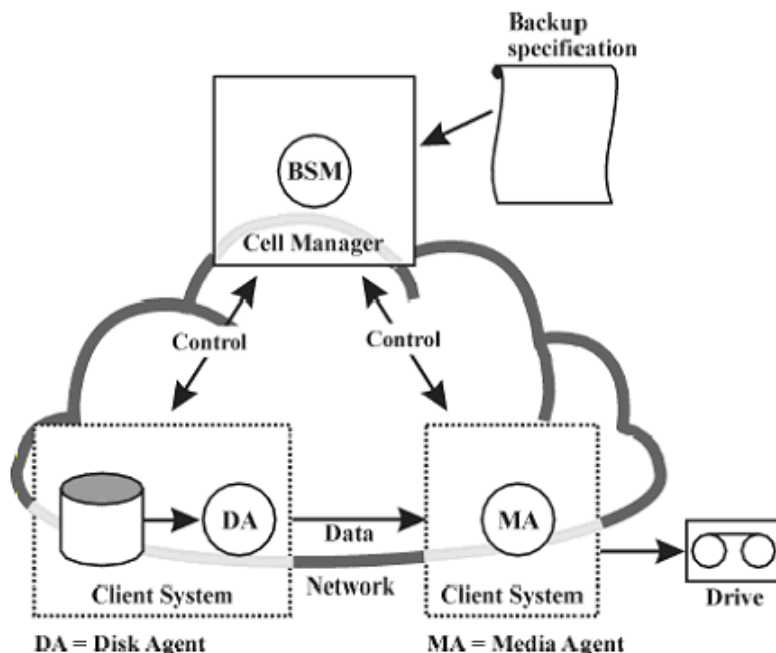
A backup session is a process that creates a copy of data on storage media. It is started either interactively by an operator using the Data Protector user interface, or unattended using the Data Protector Scheduler.

How does a backup session work?

The Backup Session Manager process starts Media Agent(s) and Disk Agent(s), controls the session, and stores generated messages to the IDB. Data is read by the Disk Agent and sent to the Media Agent, which saves it to media. A number of Disk Agents read data from multiple disks in parallel and send data to one or more Media Agents.

Backup steps

Whether a backup session is started interactively or from the Data Protector Scheduler, the data flow and processes for a standard network backup are as follows:



1. The Backup Session Manager (BSM) process is started on the Cell Manager system and controls the backup session. This process reads the backup specification for information on what to back up, and which options, media, and devices to use for the backup.
2. The BSM opens the IDB and writes to the IDB information about the backup session, such as generated messages, details about the backed up data, and the devices and media that were used for the session.
3. The BSM starts Media Agents on the systems with devices configured for backup. A new Media Agent is started for each drive used in parallel. The number of Media Agents that can be started in the cell is limited by the number of licenses purchased and the cell configuration.
4. The BSM starts Disk Agents for each disk to be backed up in parallel. The actual number of Disk Agents started depends on the concurrency of Disk Agents configured in the backup specification. This is the number of Disk Agents that can be started to send data in parallel to a Media Agent, thus allowing a device to stream.
5. Disk Agents read data from disks and send it to the Media Agents that write data to media. The BSM monitors the progress of the session and starts new Disk Agents and new Media Agents, as necessary.
6. When the backup session is completed, the BSM closes the session.

What is a restore session?

A restore session, shown in the following illustration, is a process that restores data from previous backups to a disk. The restore session is started interactively by an operator using the Data Protector user interface.



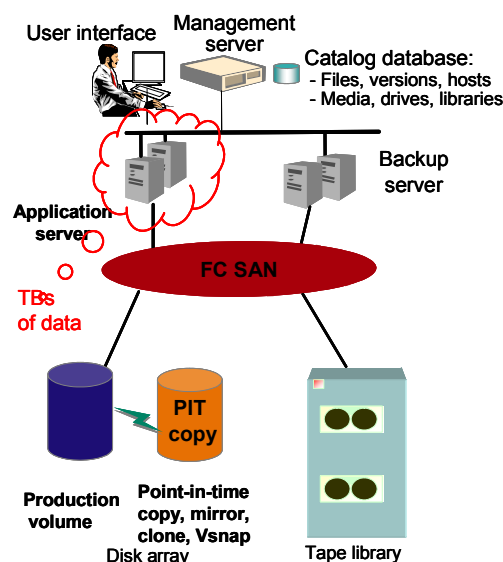
How does a restore session work?

After the files to be restored from a previous backup are selected, the actual restore is invoked. The Restore Session Manager process starts the required Media Agent(s) and Disk Agent(s), controls the session, and stores messages in the IDB. Data is read by the Media Agent and is sent to the Disk Agent, which writes it to disks.

Zero Downtime Backup

Data Protector Zero Downtime Backup (ZDB) uses the point-in-time copy of the production volume mounted to the backup server to be backed up to a tape library. The application server does not participate in the backup process, therefore it does not undergo any performance degradation. ZDB deploys a serverless backup that uses **storage replication** and a **backup processor** to isolate the application server from the backup process.

HP supports the broadest range of ZDB configurations across applications, operating systems and storage architectures.



HP EVA with snapclone, Vsnap, standard snapshot

- Supported operating systems
 - HP-UX 11.0, 11.11
 - Solaris 8
 - Windows 2000
 - Windows 2003 (32-bit)*
- Supported databases and applications
 - Oracle 9i
 - SAP R/3
 - SQL Server 2000, Exchange 2000
 - Benefits
- Eliminates the backup windows
- Zero performance degradation of the production environment

Snapshot backup

The snapshot backup technique is an implementation of the Zero Downtime Backup concept. ZDB is a backup process that uses data replication technologies to minimize the application database downtime (offline backup) or backup mode time (online backup) during the backup to the short time needed to create the snapshot. With regard to the data replication technology used, ZDB denotes the split mirror backup or snapshot backup.

Phase 1 — disk backup

In a typical snapshot environment, an application is running on the application system, with its data storage (original storage) residing on a snapshot disk array.

When a snapshot backup is started, a replica storage version is created and the data in original storage is replicated to the replica storage version—snapshots are created or reused. The ZDB process may terminate at this point, thus providing a copy of the data in the replica storage version that can be used for recovery purposes. Such a recovery is performed by internally (with regards to the disk array used) restoring the data from the replica storage version to the original storage and is referred to as instant recovery. If the ZDB process is terminated, then only instant recovery is possible from the backed-up data in the replica storage version.

Phase 2 — move data to tape media

The second phase of snapshot backup assumes that the ZDB process was not terminated after the creation of the replica storage version. In this case, the replica storage version is subsequently used by the backup system, which has some tape devices connected.

The data in the replica storage version is backed up to media using the Media Agent on the backup system, which allows the application to run on the application system with minimal performance degradation. Then, the snapshots and replica storage version may or may not be deleted, depending on the backup options selected. The time frame in which the application is in backup mode (online backup) or down (offline backup) is limited to the time that it takes to create snapshots. Data from the tape media can be used for recovery purposes. Such a recovery is performed by restoring the data from the tape media to the original storage — a standard Data Protector restore process.

Online backup in Zero Downtime Backup environments

Online backup in ZDB environments should not be confused with the online backup in non-ZDB environments.

- Online backup in the context of non-ZDB environments means that the application database is in backup mode for the entire duration.
- Online backup in the ZDB context means that the application is in backup mode only for the duration of the snapshot creation. The backup that follows is identical to an offline backup (of the just created snapshot). However, the application tracks the creation of archive logs to be used for a consistent restore.

ZDB concepts

The Data Protector ZDB tape backup, ZDB disk backup, and instant recovery functionality take advantage of the snapshot technology to provide an instant data backup and restore.

During a snapshot backup session, data in the replica storage version can be handled in different ways:

With...	The replica storage is...
ZDB tape backup	Moved to the backup medium; the replica storage version with its snapshots is not retained on a disk array (it is deleted) and is not marked for instant recovery, hence instant recovery is not possible
ZDB disk backup	Not moved to the backup medium; the replica storage version with its snapshots is retained on a disk array and marked for instant recovery, hence instant recovery is possible
ZDB disk/tape backup	Moved to the backup medium; the replica storage version with its snapshots is retained on a disk array and marked for instant recovery, hence instant recovery is possible

There is a variant of the ZDB tape backup, when the replica storage version with its snapshots is retained on a disk array but not marked for instant recovery. This is useful for purposes such as data mining but not for instant recovery.

Instant Recovery

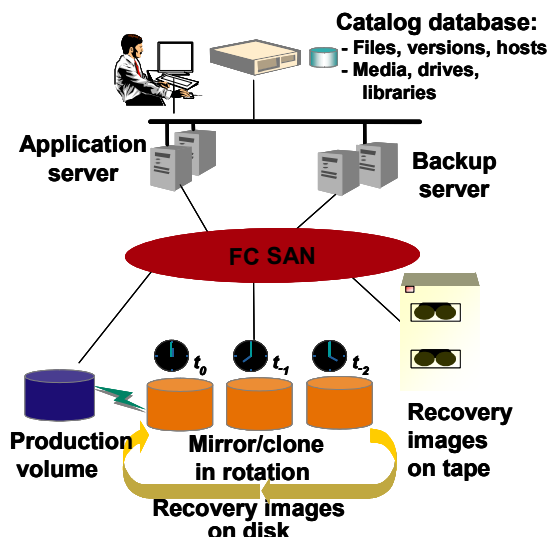
In some cases, recovery can be accomplished without any movement of data. Scheduling, data replication, and recycling of multiple recovery images can be fully automated to optimize the utilization of storage capacity.

To protect a customer's business-critical information from any risk of loss, Data Protector provides industry-leading instant recovery capabilities, based on mirroring and snapshot technologies supported by online storage arrays including HP StorageWorks XP, VA, and EVA systems. (Mirroring and snapshots are discussed in previous modules in this course.)

Mirroring and snapshot technologies use disks rather than tape as recovery media. With disk-based recovery, Data Protector can recover terabytes of data in minutes, rather than hours.

During instant recovery, the data on the specified retained replica storage version (left frozen at the point in time of the backup) is restored using the disk array functionality of the original storage by overwriting it, without a tape media restore involved.

During instant recovery, a ZDB disk or ZDB disk/tape backup session is selected using the Data Protector user interface and the replica storage version used in the selected session is used for the restore. Instant recovery restores the data from the replica storage version that is selected to the original storage by overwriting the data in the original storage. Only the replica storage versions marked for instant recovery can be used for instant recovery, which means that instant recovery is only possible for the data backed up in ZDB disk and ZDB disk/tape backup sessions.



HP EVA with snapclone , Vsnap, standard snapshot

- Supported operating systems
 - HP-UX 11.0, 11.11
 - Solaris 8
 - Windows 2000
- Supported databases and applications
 - Oracle 8 and 9i
 - SAP R/3
 - SQL Server 2000, Exchange 2000

Benefits

- Eliminates the recovery windows
- Recovers terabytes of data in minutes from clone

This graphic shows how the components of the data center function together to provide protection.

1. Application servers, running one of a variety of applications, store their production data on an intelligent disk array.
2. Data Protector software, operating on a management server, triggers a protection event based on its internal scheduler, causing the application on the application server to quiesce.
3. This enables the disk array to split off a snapshot, clone, or split-mirror containing a consistent recoverable image of the production data.
4. That image can be copied to tape for disaster recovery or off-site archiving purposes, if necessary. It can also be retained on disk for instant recovery. Multiple disk-based images can be maintained, with Data Protector software automatically rotating the oldest images off to recycle the storage space for the next recovery image to be created.
5. If recovery is needed, Data Protector has a single, consistent interface to allow administrators to select either tape-based or disk-based images for recovery.

System disaster recovery

For system disaster recovery, Data Protector offers the following alternatives:

- **Disk delivery** — Recreates the crashed system disk on any other Data Protector agent. Administrators can reconstruct an image of a failed server disk from a separate recovery server, and then simply reboot the failed server based on the reconstructed disk image.
- **One-button disaster recovery** — The crashed system reboots from a tape image and rebuilds its internal disk image with almost no operator interaction.
- **Enhanced automatic disaster recovery** — Creates a recovery diskette. The operating system and Data Protector agent are installed unattended.
- **Assisted manual disaster recovery**
 - Install operating system
 - Use the Data Protector restore command
- **Manual disaster recovery** — Install the operating system and Data Protection agent, then restore data from tape

What distinguishes HP disaster recovery

The features that distinguish HP disaster recovery from other disaster recovery solutions are:

- Advanced remote clustering for major operating environments — supports campus cluster, metro cluster, continental clusters for HP-UX with MC/ServiceGuard, Microsoft Cluster Server clustering implementation, Solaris, AIX, and Linux
- Management integration with Command View plug-in
- Zero downtime backup and rapid recovery capabilities
- Comprehensive HP services worldwide — provides for a single point of responsibility, including HP consulting, mission-critical support, and business-recovery services with worldwide recovery sites

Volume Shadow Copy Service

Data Protector is adding the support of the new Microsoft Volume Shadow Copy Service (VSS). In addition to the **array controller-based** API for doing the snapshot backup, Data Protector is integrated with Microsoft Volume Shadow Copy Service (VSS) to offer the **host-based** snapshot backup for any application and databases that are compatible with VSS.

VSS allows:

- Creation of shadow copy backups of volumes
- Coordination of providers, writers and requestors

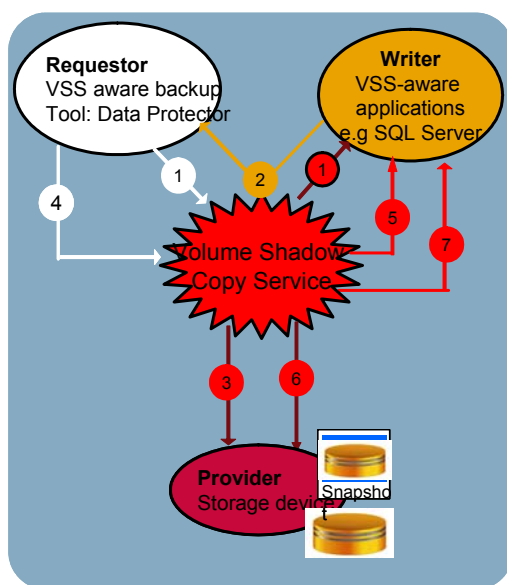
Data Protector is fully integrated with VSS (support only for Windows 2003) providing:

- Backup of open files, databases, and applications
- Consistency and integrity of backed up volume

How VSS works

The following three VSS-aware components need to be available:

- **Requestor** — Backup software that initiates the creation and the destruction of the shadow copy. In our case the backup software is Data Protector
- **Writer** — Application or database software that participates in the shadow copy process (for example, SQL Server 2000)
- **Provider** — Storage solution used for the shadow copy (disk array)



The Shadow Copy process

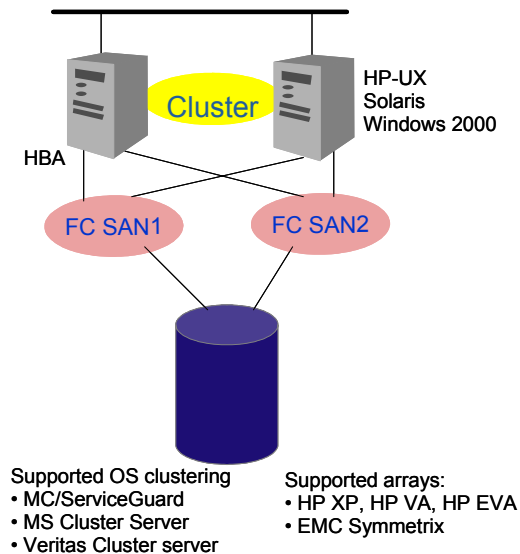
1. Data Protector asks the Volume Shadow Copy service which applications will be involved and accumulates their meta data.
2. The application supplies backup elements and sets parameters needed for the restore.
3. The Shadow Copy service identifies which providers (storage devices) are available.
4. Data Protector asks the Volume Shadow Copy service to create the shadow copy
5. The Volume Shadow Copy provides a frozen image of the application *writer)
6. The Volume Shadow Copy service tells the provider to make a shadow copy of the prevailing disk state and backs up the frozen image to the tape.
7. The Volume Shadow Copy services unfreezes the writers.

Comparing Zero Downtime Backup and VSS

	ZDB	VSS
What it is	Array-based data mirroring	Host-based data mirroring
Disk storage requirements	VA, XP, EVA, EMC Symmetrix, HDS	Any disk
OS requirements	HP-UX, Windows Server 2003, Windows NT, Sun Solaris	Windows Server 2003 only
Software requirements	HP StorageWorks Business Copy software	VSS (included in Windows Server 2003)
Applications supported	Oracle, Exchange, SQL Server, SAP	Any VSS compliant application
Snapshot management	Can manage up to three snapshots automatically	Any storage supported under VSS (having a VSS snapshot provider)
Backup management	Backup to tape via a separate server (application-free backup)	Backup to tape can impact performance of application
Recovery management	Recovery from tape or disk (instant recovery)	Recovery from tape

High availability multi-pathing support

Data Protector supports multi-pathing software for various arrays, increasing the availability of the backup/recovery jobs should one of the SAN component fails.



Data Protector supports different types of multi-pathing software to offer a greater availability of data

- HP Auto Path for XP and VA
- HP Secure Path for EVA
- Power Path for EMC

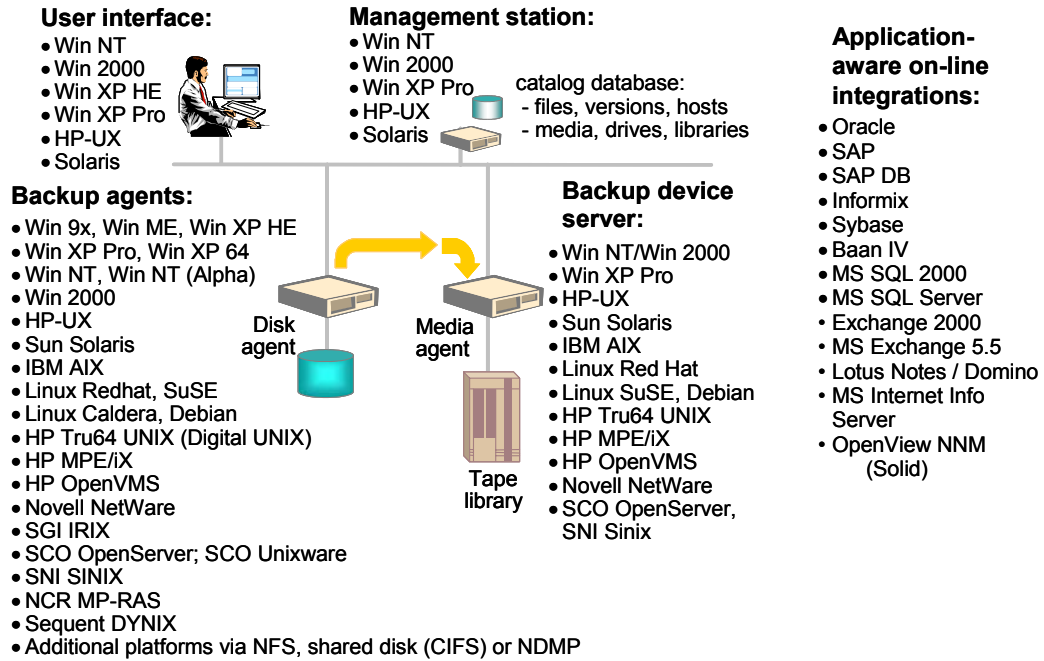
In clustered environments

- MC/ServiceGuard for HP-UX
- Veritas Cluster Server for Solaris
- Microsoft Cluster Server for Windows 2000

So, to eliminate the single point of failure of SAN interconnect components (HBA, switch, fabric)

Data Protector interoperability

Data Protector scales with clients needs by providing local, LAN- and SAN-based backup on a broad base of operating platforms. Recent qualification of Tru64 UNIX and OpenVMS open up the market further for this solution.



Data Protector business value

- Increases the availability of information
 - Eliminates backup windows and recovery windows
- Increases staff efficiency
 - Ease of deployment and use; automation
 - Consistent look and feel across platforms
- Increases infrastructure efficiency and utilization
 - Library sharing, LAN-free, load-balancing, compression, and clustering
- Increases scalability
 - Single solution for small, medium, and large enterprises, and across operating systems
 - Most scalable product in the market
- Preserves customer choice
 - Simple, modular structure
 - Broad compatibility across platforms, operating systems, libraries, and applications

Qualifying questions

Use the following questions to qualify opportunities for the sale of HP OpenView Storage Data Protector.

- Are you comfortable with your current data protection strategy?
- Do you want to centralize your backup management?
- Are you moving toward an automated data environment?
- What would it mean to your IT staff to use a single set of backup and recovery software tools to manage data from multiple operating systems?
- How long can your business wait to recover data from downtime?
- Would you like to achieve higher levels of data protection using the same IT resources?
- What would 24x7 customer access to more of your services mean for your business?

HP 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.

Key market trends

- Explosion in data growth
- Customer focus on data availability and recoverability
- Flat or declining IT operations staff levels
- Increasing cost of managing storage
- Need for centralized, automated storage management tools

Target customer characteristics

Target customers for HP OpenView Storage Media Operations include IT organizations from any industry sector who:

- Manage hundreds or thousands of removable storage media each day
- Want to assure data availability while maximizing the effectiveness of media operations

Characteristics by job title

Job title	Requirements
CIO	<ul style="list-style-type: none">▪ Reduced corporate risk of data loss▪ Improved cost efficiency
Backup administrator	Faster restores
Media managers	People-efficient backup and restore media-handling processes
Media operators	Clear, task-focused tool for use on the job

Potential opportunities

Opportunity	Watch for
Best opportunity	<ul style="list-style-type: none">▪ Any industry sector or company size▪ UNIX, Linux, or Windows system environment▪ Uses Data Protector or any other leading backup application and needs a media management solution▪ Dissatisfied with home-grown tools
Good opportunity	Optical removable media (can be tracked but applications require integration using the XML SDK)
Least advantageous opportunity	Mainframe environments

Customer business need: media management

Look for customers with the following needs or experiences:

- **Availability** — never lose valuable data

The copying of increased amounts of customer data to removable storage media creates a physical asset management problem on a huge scale. In many cases, companies are dealing with hundreds or thousands of tape and other removable storage media movements each day as backup capacities grow.

- **Recoverability** — assured ability to recover data after accidental loss

Without effective management tools to track media and direct media-handling operations, organizations run the risk of losing valuable backup tapes, which puts their ability to recover data at risk.

- **Operations effectiveness** — do more with less

Haphazard media management procedures are non-productive in terms of operational effectiveness and can result in wasteful media asset utilization. Many customers have put in place home-grown tools such as shell scripts or spreadsheets to try to solve this problem, but have already become dissatisfied with the lack of sophistication of these methods and the rising costs of keeping those tools up to date.

Customer business value

Unlike “home-grown” tools, Storage 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, Storage Media Operations monitors media quality and preloads libraries with sufficient scratch tapes.

Designed in partnership with data center staff, Storage Media Operations maximizes the effectiveness of media procedures by creating daily task lists, organizing tasks for logical data center walk-throughs, and by enabling operator control of tape libraries, bar code scanners, and media label printers.

Customer benefits of Storage Media Operations

Storage Media Operations delivers the following benefits:

- Reduces the time that it takes IT to do data restores by enabling them to find the correct piece(s) of media when they are needed
- Improves data availability by accurately tracking hundreds or thousands of removable storage media such as magnetic tapes
- Enforces corporate policies on data retention and media recycling to reduce the risk of data loss from media-handling errors
- Saves IT money by maximizing the effectiveness of media operations by:
 - Creating task lists that direct media-handling processes
 - Organizing tapes in logical data center walkthrough order
 - Providing operator control of removable storage devices such as tape drives
 - Measures the effectiveness of media operations by defining service level operations and monitoring progress against them
- Storage Media Operations is fully integrated with HP OpenView Storage Data Protector to ensure the completion of backup tasks by preloading libraries with sufficient quantities of good quality media

Media management and traditional backup recovery

Storage Media Operations complements conventional enterprise backup and recovery software, such as Data Protector, by providing extensive media tracking and management facilities that are typically not part of the design scope of backup and recovery applications. The following table compares media management with backup and recovery.

Backup and recovery	Media management
HP OpenView Storage Data Protector <ul style="list-style-type: none">■ Focuses on protecting data by creating copies on fixed or removable media■ Manages the backup and recovery processes■ Manages online media effectively, but is not designed for managing offline or offsite media■ Does not direct or optimize labor-intensive media-handling procedures■ Does not interact with offsite vaulting service providers and storage media suppliers	HP OpenView Storage Media Operations <ul style="list-style-type: none">■ Focuses on managing the removable media created by backup/recovery applications■ Tracks media regardless of location■ Enforces media retention and rotation policies■ Ensures backup success by calculating backup capacity requirements and by preloading libraries■ Directs daily media-handling tasks■ Organizes tapes in a logical order■ Controls hardware devices such as tape libraries, bar code scanners, and media label printers■ Manages data exchange with offsite service providers and storage media suppliers

Storage Media Operations features

Without Storage Media Operations, companies that have hundreds, thousands, or even hundreds of thousands of media containing backup and archival information run the serious risk of losing data. The three key attributes of Storage Media Operations are controllability, resiliency, and extensibility.

Controllability

- Creates daily task lists and organizes tapes for logical data center walk-throughs which empower operator control of removable storage devices for tape loads and ejects
- Automates data exchange with backup applications, offsite vaulting services, and removable media suppliers
- Enables operator control of removable storage devices for tape loads and ejects
- Supports bar code scanners and media label printers
- Eliminates the cost of supporting “home grown” tools for less than 3% of the total media bill

Resiliency

- Accurately tracks all media, regardless of location
- Enforces data retention and media recycling policies
- Ensures backup completion through library preloads

Extensibility

- Tracks from tens to hundreds of thousands of individual media pieces
 - Entry-level License to Use for up to 2,000 pieces of media
 - Enterprise-level License to Use for up to 10,000 pieces of media
 - Unlimited media License to Use for unlimited media
- Works with HP OpenView Storage Data Protector and any other leading backup and recovery application

Note

Other applications will initially be supported by an XML-based software developers kit (SDK). Future Storage Media Operations releases will include out-of-the box integrations for Enterprise Backup Solutions (EBS), such as Veritas and Legato products, using a Java-based integration agent.

Hardware supported

- Any tape library supported by HP OpenView Storage Data Protector for tape ejects and loads
- Zebra thermal 300 dpi bar-coded media label printer
- Any scanner that has keyboard emulation with “Enter Key” suffixing (for example, automatically adds an “Enter Key” keystroke to each scanned bar code)

System requirements

	Server	Integration Agent (XML Gateway)	PC Client (GUI)
Operating system	<ul style="list-style-type: none">■ Windows NT 4.0 sp6 or higher■ Windows 2000	<ul style="list-style-type: none">■ Windows NT■ Windows 2000■ HP-UX 11.0 or later■ Solaris 7■ Solaris 8	<ul style="list-style-type: none">■ Windows 98 SE or later■ Windows NT 4.0 sp6 or higher■ Windows 2000■ Windows XP
CPU	Dual Pentium III, 500MHz or higher		Celeron and above
System memory	512MB RAM or higher		256MB RAM minimum
Disk capacity	200MB or more free disk space		25MB free disk space
Other	Supports multiple Data Protector Cell Managers from a single Storage Media Operations server		Web client: requires Microsoft Exchange or Netscape Navigator

Implementation services

A recommended installation and startup service is available for Storage Media Operations. Performed by trained, experienced HP application systems engineers, the implementation service assures quick, trouble-free installation and successful operation. This service includes:

- Installation of the software on the management appliance
- Configuration of the software
- Working with customers to establish services within their environment

Professional Consulting Services

Professional Consulting Services enables customers to grow their storage landscape according to their business needs, while using HP Storage Media Operations expertise to keep manageability of this environment with their existing IT staff.

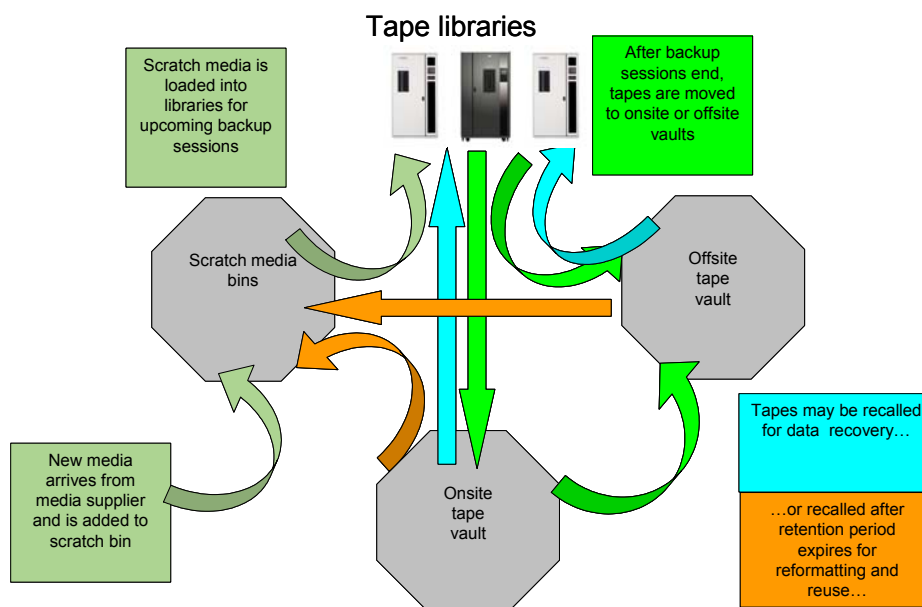
- **Design** — environment assessment, change management, talent evaluation, technology refresh
- **Build** — strategic design, solution planning, financial structuring
- **Run** — project management, integration/implementation, solution deployment, flexible financing
- **Evolve** — business recovery, continuous education, software support, mission-critical support

Support information

The wide range of service offerings enables customers to choose the support program that best matches their needs. Options include:

- **Customer care standard** — Phone-in assistance; 8x5 unlimited telephone support, timely software updates; versions and revisions. This option is included in the price of each HP OpenView software product.
- **Customer care extended** — Includes all benefits of customer care standard plus 24x7 phone-in assistance.
- **Customer care premier** — Encompasses a proactive, personalized service for large or complex, multi-platform environments. Provides dedicated support personnel focused around three key activities:
 - Business alliance management
 - Proactive problem avoidance
 - Onsite technical services

Key software features and how it works



Operational steps

1. New media arrives and is initialized and labelled. It is then placed in a scratch media bin.
2. Media that has previously been used but has expired is also returned from offsite or onsite vaults and placed in the scratch media bins for future use.
3. Before each backup session (or a group of backup sessions), scratch media is taken from the scratch media bins and loaded into the tape library (or libraries). Storage Media Operations ensures that the correct amounts of good quality media are preloaded into the libraries before the backup session(s) begin.
4. After the backup sessions complete, media is moved from the library (or libraries) to either the onsite or offsite tape vaults. Storage Media Operations tracks the media as it moves between locations and also creates job lists and inventories that direct and document the process.
5. Finally, should data need to be recovered from backup tape; Storage Media Operations quickly identifies the required tape(s) and manages the return of the media from its current location to the recovery site.

Builds a model of the environment

Storage Media Operations contains an administrator-defined model of the physical world. This model includes:

- Definition of the sites
- Data centers in each site that contain backup devices and protected systems
- Definition of a “device walk-through” order for each data center
- Definition of scratch bins
- Description of onsite vaults and offsite locations

Storage Media Operations also maintains a model of the data protection environment for backup servers and backup jobs, protected systems, tape libraries, media, and media pools.

Storage Media Operations automatically communicates with the backup application (using a firewall-friendly HTTPS link) to generate the model and stay current if any configuration changes occur.

This is a policy-driven system that drives the daily media operations. It allows customers to define their business rules once. These once-stated rules govern the “normal” business operation, while also accommodating flexibility for “special” cases. Vaulting (storage) policies cascade downward over the key elements of the system that is defined. Scratch policies define how much of each media type to load into which tape devices.

Premounts jobs

The premount process uses advanced algorithms to determine how much media needs to be loaded into each device before a backup begins. And, the jobs are created for operators to load devices before the backups start. This enhances operational effectiveness by making sure that the customer does not run out of media in the middle of a backup.

Eliminates errors and speeds disaster recovery

The features of Storage Media Operations work together to eliminate backup and recovery errors, speed the recovery of the correct media from onsite and offsite vaults, and optimize retrieval time.

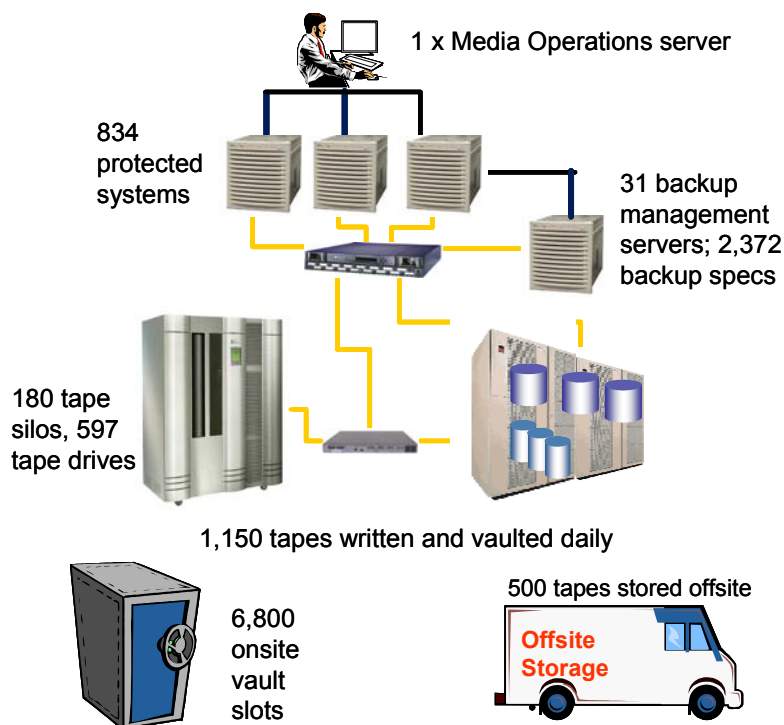
HP Storage Media Operations differentiators

HP has the only solution that was designed in close partnership with IT operations staff to optimize the daily task of managing nearly 900,000 tapes used in HP data centers worldwide. As such, the tool takes care of all aspects of media management throughout its life cycle. The emphasis is on operational effectiveness that will benefit any organization faced with rapidly increasing storage capacity but negligible headcount growth.

Storage Media Operations is a product taken from a large IT organization, with a use model proven over years. Its feature differentiators include:

- A task-oriented interface aimed at operator-level procedures
- Retention governed by user-defined policies
- Direct library control support through backup engine
- Integration with Data Protector out of the box
- XML API to integrate other backup engines
- Third-party offsite storage vendor interaction
- Far code scanning and label printing supported
- Firewall support in an IT environment

How HP uses Storage Media Operations



Example: HP Boise, Idaho data center

Storage Media Operations runs on a Windows NT or Windows 2000 Server and supports Windows PC or Web browser clients. All media movements are tracked in an underlying database that can track hundreds, thousands, or hundreds of thousands of individual pieces of removable storage media.

Tight integration with industry-leading backup and recovery applications such as HP OpenView Storage Data Protector allow efficient data interchange of media and contents created during routine backup sessions. Storage Media Operations also enforces all corporate policies regarding data retention periods and media recycling.

By creating structured "job lists" that direct all media-handling operations, and by giving the operator full control of the devices in the media management environment, Storage Media Operations maximizes the efficiency of the staff engaged in daily media-handling procedures.

Dedicated audit support functionality significantly reduces the time taken to perform an audit of all removable storage stored across multiple company owned, and service provider vaulting sites.

Calculating Storage Media Operations ROI

HP Operations (HPO) manages 900,000 tapes across approximately 21 major data centers in North America, Latin America, Europe, Asia Pacific and Japan. Media capacities range from 30,000 tapes to 160,000 tapes depending on the site.

- Prior to using Storage Media Operations, HPO media staff managed all tapes using vaulting lists by individual server. All tapes were stored in numerical order.
- With Storage Media Operations, vault tapes can be stored logically by slot instead of numerical order.

To calculate the ROI, the HPO media manager and tape librarian studied the different processes performed including how long each took prior and after implementing Storage Media Operations.

- Before implementing Storage Media Operations, they estimated that they could pull and store tapes manually at the rate of 3.33 tapes per minute.
- After implementing Storage Media Operations, they estimated that they could pull and store 6.26 tapes per minute.

This is an 88% improvement in productivity over the manual process. To calculate the savings:

1. Hypothetical savings are based on an hourly rate of \$60 x 2.33 hours per 1,000 tapes, x 6 days per week x 50 weeks per year = \$42,000 annual per 1,000 daily tape operations.
2. Customers should also factor in the cost of maintaining a home-grown media management tool and the business cost of lost data resulting from inadequate media tracking.

Competitive overview

The main competition for media operations comes from “home-grown” tools developed by customers and from traditional storage management software vendors such as Veritas and Legato.

Home-grown tools are often based on database applications such as Microsoft Access or Excel or on UNIX scripts. Paper-based tracking is often a feature of home-grown solutions. These tools are regarded by most users as lacking in features and are expensive to maintain.

Tools from other storage management software vendors that are focused on application areas such as library sharing, disaster recovery planning or tape duplication tend to deemphasize features that maximize the effectiveness of media management operations, such as daily task list creation, logical data center walkthroughs and service level management. Many of these tools are only supported with the backup/recovery tools supplied by the same vendor.

Tools that are offered by niche vendors that do not have broad experience that HP has in managing enterprise storage network environments tend to lack key features, for example those that provide direct operator over key activities such as library tape ejects and scratch tape initialization. Some of these smaller vendors also have limited support capabilities in some countries.

Qualifying questions

Use the following questions to qualify HP OpenView Storage Media Operations opportunities:

- Do you regularly back up data to tape?
- What is your estimate of the number of media pieces that your IT operations must track?
- Would you be interested in an easy automated way to manage your backup media and/or to archive your backups?
- Do you want to improve resilience and reduce cost of media management operations?
- Would you like to improve media operations staff productivity?
- Would it be valuable to redeploy staff that currently supports home-grown media management tools?
- Is your data open-systems based?
- Do you support a centralized or geographically distributed IT environment?
- Are you subject to data retention regulations?
- Are you subject to security standards?
- When was the last time that you performed an audit of your onsite and offsite archiving processes and tapes?
- Are your data retention policies at risk to human errors?

Combining Storage Media Operations and Data Protector

Storage Media Operations complements conventional enterprise backup and recovery software such as Data Protector. It does this by providing extensive media tracking and management facilities that are typically not part of the design scope of backup and recovery applications, as shown in the following table:

Data Protector	Storage Media Operations
<ul style="list-style-type: none"> ■ Tool for managing the backup and recovery processes ■ Effective at managing online media but not designed for managing offline or offsite media ■ Does not direct or optimize labor-intensive media-handling procedures ■ Does not interact with offsite vaulting service providers and storage media suppliers 	<ul style="list-style-type: none"> ■ Tracks media regardless of location ■ Enforces media retention and rotation policies ■ Ensures backup success by calculating backup capacity requirements and by preloading libraries ■ Optimizes effectiveness by: <ul style="list-style-type: none"> – Directing daily media-handling tasks – Organizing tapes in a logical order – Controlling hardware devices such as tape libraries, bar code scanners, and media label printers – Managing data exchange with offsite service providers and storage media suppliers

Customers can maximize the effectiveness of Storage Media Operations by using a tool that directs daily tasks from structured job lists and that provides the operator with full control of the media management environment including:

- Hardware control over tape library loading and media ejections
- Use of hand-held bar-code scanners for fast data entry
- Convenient local printing of bar-coded media labels

Robust tracking and reporting also radically decreases the time required to perform full audits of all removable media assets across multiple locations.

Summary

- Customer business needs addressed by Data Protector
 - Data protection and management
 - Consolidation of backup resources
 - Business continuity
 - Storage interoperability
- Data Protector value proposition
 - Integrates disk-based and tape-based recovery in a single product across multiple applications, operating systems, and storage architectures and increases staff efficiency
- Benefits of Data Protector
 - Improved information availability
 - Simplified asset management
 - Scalability
 - Reduced cost of downtime
 - Increased application service levels
 - Increased operational efficiency
- Customer business needs addressed by Storage Media Operations
 - Availability
 - Recoverability
 - Operational effectiveness
- Storage Media Operations value proposition
 - 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
- Benefits of Storage Media Operations
 - Reduces the time that IT time takes to do data restores
 - Improves data availability
 - Enforces corporate policies
 - Saves IT money by maximizing effectiveness
 - Measures the effectiveness of media operations
 - Integrated with HP OpenView Storage Data Protector

Learning check

1. The HP OpenView Storage Data Protector Instant Recovery function uses tapes as recovery media.
☐ True
☐ False
2. One of Data Protector's key value propositions is that it:
 - a. Provides tape-based full and incremental backup protection
 - b. Provides I/O channel redundancy in the event of hardware failure
 - c. Is the only tool that integrates disk-based and tape-based recovery in a single product across multiple applications, operating systems and storage architectures
 - d. Is a low-cost alternative to expensive tape farms
3. All of the following HP OpenView Data Protector capabilities distinguish it from the competitors **except**:
 - a. Advanced remote clustering for major operating environments
 - b. Zero Downtime Backup and rapid recovery capabilities
 - c. Comprehensive HP worldwide services
 - d. Incremental backups
4. Which of the following best describes the Volume Shadow Copy Service?
 - a. Host-based data mirroring that allows for recovery from tape or disk
 - b. Host-based data mirroring that allows for recovery from tape only
 - c. Array-based data mirroring that allows for recovery from tape only
 - d. Array-based data mirroring that allows for recovery from tape or disk
5. With a Zero Downtime Backup (ZDB) **tape backup** configuration, what happens to the replica storage?
 - a. Moved to the backup medium; the replica storage version with its snapshots is not retained on a disk array (it is deleted) and is not marked for instant recovery, hence instant recovery is not possible
 - b. Not moved to the backup medium; the replica storage version with its snapshots is retained on a disk array and marked for instant recovery, hence instant recovery is possible
 - c. Moved to the backup medium; the replica storage version with its snapshots is retained on a disk array and marked for instant recovery, hence instant recovery is possible
 - d. None of the above

6. Which of the following is not recommended as a full data protection solution?
 - a. Backup and incremental backups to MSA1000 drive array and then backup off-line to tape or optical libraries on-site or off-site
 - b. Full backup to tape and then incremental backup to MSA drive array
 - c. Backup and restore to and from MSA drive array only
 - d. Full backup to and restore from tape only
7. HP OpenView Storage Media Operations can support all of the following operations, except:
 - a. Performing online backups
 - b. Enforces media retention and rotation policies
 - c. Ensures backup success by calculating backup capacity requirements and by preloading libraries
 - d. Tracks media regardless of location
8. The Storage Media Operations software can track online, offline, and offsite media.

☐ True
☐ False
9. The Enterprise Level License of Storage Media Operations will support environments with up to _____ pieces of media for a single server.
 - a. 2,000
 - b. 10,000
 - c. 50,000
 - d. Unlimited
10. The least favorable type of opportunity to sell Storage Media Operations is:
 - a. UNIX, Linux, or Windows system environments
 - b. Customers who use Data Protector or any other leading backup application and needs a media management solution
 - c. Mainframe environments
 - d. Customers who are dissatisfied with home-grown media management tools

Objectives

After completing this module, students should be able to:

- Describe the business needs of network storage services customers.
- Describe the HP NSSv (Network Storage Services Group) value proposition.
- Describe the types of NSSv services.

Overview

Customers are facing increasing challenges to optimize their IT environments. HP Network Storage Services can help customers create an adaptive storage infrastructure, enabling them to increase business flexibility, lower risk, and demonstrate a faster return on investment. Network storage services complement the HP hardware and software portfolios to provide a total solution for customers.

Customer business needs

- Maximize availability and reduce risk
 - Maximize business value
 - Improve/optimize storage return on investment
- Cut costs and do more with less
 - Increase business agility
 - Manage multivendor environments
 - Deal with relentless capacity growth
- Ensure business continuity
 - Implement effective disaster tolerance
 - Maintain application availability
 - Maintain data security
 - Comply with archiving regulations

Customer demand

“79% of SAN managers would enlist outside assistance for their next SAN.”

Source: Gartner Group

According to the Gartner report, the key reasons that IT managers would use external storage services for their next SAN include:

- Reduce time to “return on IT”
- Cut costs
- Lower risk
- Do more with less
- Obtain a complete solution

The Gartner Group also estimates that more revenue growth exists in the market for network storage services, making it an important component of HP end-to-end solutions for customers.

Network Storage Services Group (NSSv)

Network Storage Services continues to play an increasingly critical role in the success of the HP network storage solutions. NSSv is one of the key reasons why HP is the worldwide market leader today, complementing network storage hardware and software and contributing to increased market share.

NSSv mission

Ensure customer success by delivering, with partners, the industry's best-in-class network storage services and open networked storage solutions that address the customers' business needs.

NSSv strategy

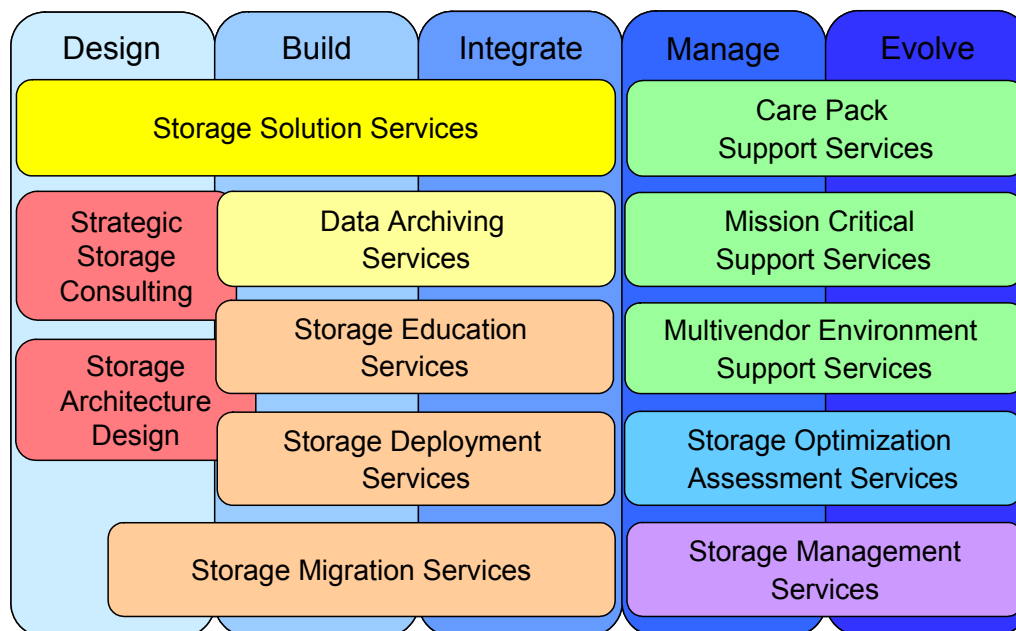
- Complement enterprise IT solutions
- Provide integrated partnerships
- Provide complete customer solutions

NSSv value proposition

- Optimize customers' storage infrastructures with HP services to help them win with business agility
 - Business agility is a competitive advantage
 - ◆ Makes it easier...
 - ◆ Cuts time needed...
 - ◆ Expands ability...
...to harness change for success
 - Make storage work for customers
 - ◆ Cut costs
 - ◆ Cut downtime
 - ◆ Speed time to market
 - Increase return on IT
 - ◆ Improve business efficiency, continuity, and results

Network storage services (NSSv) portfolio

The HP portfolio of network storage services is summarized and portrayed here against the five lifecycle phases of IT services. HP expertise covers the full life cycle of storage services, from the design, build, and integrate phases to managing and evolving the entire storage infrastructure.



Storage Solution Services

- SAN Solution Service
- Backup and Rapid Recovery Solution Service
- Data Replication Solution Service
- Disaster Tolerant Management Service
- Storage Virtualization Solution Service
- Storage Area Management (SAM) Solution Service

SAN Solution Service

As the SAN market leader, HP has more experience implementing SANs than any other vendor. We have completed thousands of successful implementations around the world, and have perfected this service, which consists of three major activities:

- Project management (which may be done remotely)
- System integration consulting
- Customer support engineering

This service provides the customer with design, installation, integration, testing, project management, documentation, and knowledge transfer services, ensuring a right-the-first-time SAN implementation based on HP best practices.

Backup and Rapid Recovery Solution Service

This service is similar to the SAN Solution Service but is focused on providing the customer with rapid backup and recovery capabilities. It integrates snapshots with tape automation and disk-based recovery and supports HP OpenView Data Protector plus other popular backup packages that our customers are using.

Level 2: Heterogeneous SAN integration

Data Replication Solution Service

The Data Replication Solution Service is the most appropriate service to get a data replication solution, local and/or remote in homogeneous and heterogeneous environments, fully integrated and operational within some well defined boundaries reflecting the natural limits of a fixed priced service. Requirements beyond these boundaries are going to be covered by SOW-driven consulting services using Data Replication Solution Service as a fundamental building block for delivering more complex solutions.

The Data Replication Solution Service is comprised of three levels of services, with a menu of standard service options that tailors the service to meet the specific replication needs of the customer:

- Level 1 offers basic implementation services for the Continuous Access or Business Copy replication software. This level includes the installation, basic configuration, testing, documenting, and demonstrating the software.
- Level 2 provides additional tailoring and integration of data replication solution to meet specific business needs for data replication. This includes project management, design activities, basic management environment integration, functional testing, and knowledge transfer.
- Level 3 provides customer-specific integration for data replication solutions into an overall IT management application, such as HP OpenView as well as some specific application integration.

Disaster Tolerant Management Service

This service leverages industry-leading HP clustering and continuous access technologies plus the worldwide HP recovery centers to provide customers with a cost-effective, proven approach to disaster tolerance. A complete life cycle suite of services addresses:

- Customer facilities
- Infrastructure design and implementation
- Infrastructure monitoring and management
- A comprehensive disaster recovery plan
- Staff training and periodic rehearsals

The service provides a business solution approach to disaster tolerance with proven quality of service and a single point of accountability. It delivers predictable recovery times and right-first-time implementation with worldwide, multisite solution deployment.

Storage Virtualization Solution Service

The **EVM Deployment Service** is used by HP Services professionals to implement your customer's HP OpenView Enterprise Volume Manager (EVM) solution using a multi-phase process that provides a smooth, predictable startup. In addition, expert support services help ensure a sound configuration, on-schedule installation, and full productivity from day one.

The **CASA Implementation Service** allows the customer to choose the service level that matches the complexity of their SAN:

- Simple (for environments with one operating system)
- Medium (for environments with up to three operating systems)
- Complex (for environments requiring custom-designed support)

Storage Area Management (SAM) Solution Service

The SAM Solution Service is comprised of three levels of services, with a menu of standard service options that can be tailored to meet specific customer. The SAM Solution Service is focused on providing a trained product specialist who will use his/her consulting experience and in-depth knowledge of the full capabilities of the OVSAM suite of modules to provide the customer with a detailed design, installation/implementation, and integration service. The customer can select the modules for the consultant to focus, which maximizes the expertise of the HP consultant to address the needs with the greatest value at a reasonable and fair cost across each of the three levels of service available.

- Level 1 offers basic implementation services for the OpenView Storage Area Manager Suite of products, including
 - OpenView Storage Node Manager
 - OpenView Builder
 - OpenView Optimizer
 - OpenView Accountant
 - OpenView Allocator
 - OpenView Provisioner

It also optionally includes installing or upgrading the SAN Management Appliance for customers needing this option. This level includes the installation, configuration, testing, documenting, and demonstrating the software. It also includes assisting the IT Administrator in setting up the product to meet specific IT reporting needs.

- Level 2 provides additional tailoring and integration of storage management solution to meet your customer's business needs for storage management. This includes project management, design activities, tailored implementation, testing, and knowledge transfer.
- Level 3 provides the integration for a storage management solution into an overall IT management application, such as HP OpenView. This includes an environmental analysis of the overall storage needs and current state, a survey of business and process needs relative to storage, and the design of a storage management solution that would meet these needs.

Strategic Storage Consulting Services

- Storage Business Value Workshop
- Storage Investment Justification Service

Storage Business Value Workshop

Before implementing a SAN, your customers need to understand how the move to an enterprise storage infrastructure would affect their operations. And they need a realistic vision of how to take advantage of state-of-the-art SAN technology to benefit their business. The HP Services Storage Value Workshop is designed to help.

Storage Investment Justification Service

For informed cost/benefit decision-making on storage investments and management practices, your customers need a clear understanding of how efficiently their storage platforms are delivering services that satisfy their critical business requirements. This expert assessment is designed to help customers identify these cost and service-level tradeoffs in a very short timeframe.

Storage Architecture Design Services

- Storage Optimization Assessment Service
- Architecture Blueprint Service
- Storage Design Consulting Service
- Multiple Implementation Project Management Service

Storage Optimization Assessment Service

The HP Storage Optimization Assessment service provides expert storage capacity and performance analyses, optimization recommendations, and planning assistance to help customers realize higher returns on their storage investments.

Customers are provided with solution recommendations that can help them increase data availability, storage efficiency, utilization levels and network storage performance, while decreasing wasted capacity and bandwidth. Businesses are thus able to become more agile and can plan more effectively for future capacity and performance requirements.

Architecture Blueprint Service

Adopting any new storage technology involves multiple complex challenges. Whether your customers are interested in implementing a SAN, NAS technology, or a state-of-the-art enterprise backup solution, they need to take a disciplined, structured, professionally managed approach. That's why it makes sense to collaborate with HP Services storage professionals, right from the start.

Using the HP proprietary Solution Architecture Methodology, our Storage Architecture Blueprint Service gives your customers a documented blueprint — complete with a set of functional, technical, and product principles, models, and standards — for their new storage system. In addition, HP Services positions and aligns customers' storage architecture within the context of their overall infrastructure by documenting their key business drivers, strategic directions, and issues, as well as the business processes affected by their new solution.

Storage Design Consulting Service

Storage design can be an extremely complex, error-prone undertaking. Your customers can count on the experts from HP Services to help them get it right the first time.

HP Storage Design Service identifies and develops an enterprise-wide adoption strategy for a dynamic storage infrastructure within your customers' overall enterprise architecture. It provides them with a detailed enterprise storage design and implementation plan that encompasses the “three Ps” — people, product, and process — to help ensure successful design and implementation of their chosen enterprise storage architecture.

Multiple Implementation Project Management Service

When your customers have multiple storage implementation projects under way simultaneously, it is imperative to make sure that everything happens on time, on budget, and to their exacting specifications. Your customer can rely on HP Services project management experience and expertise to help keep it all under control.

This service provides customers with a senior HP Services project manager who serves as their single point of contact, responsibility, and accountability for enterprise-wide service delivery.

Storage Migration Services

- Data Migration Service
- Online Data Migration Service

Data Migration Service

HP Data Migration Services help customers minimize risks of data loss, threats to data integrity, and productivity-sapping performance slowdowns during the data-transport process. A highly experienced HP Services storage specialist works with customers to rapidly and securely migrate mission-critical business information across their data center or around the globe — regardless of their transfer technology or the complexity of their environment.

Online Data Migration Service

The Online Data Migration Service minimizes the risks of data migration to a HP StorageWorks SAN. The customer needs to move critical enterprise data to the new HP StorageWorks SAN platform without data loss and without interrupting ongoing business operations.

With Online Data Migration Service from HP, this is no problem. This unique offering supports data movement to a StorageWorks SAN from a mission-critical mainframe or open systems environments (including HP-UX, Windows NT/2000, and Sun Solaris) where data is stored on EMC, HDS, IBM, or any other legacy storage platform.

Storage Deployment Services

- Hardware and Software Implementation Services
- HP StorageWorks ESL and MSL Tape Libraries Installation and Startup Service
- Cisco MDS Switches Installation Service
- HP StorageWorks Secure Fabric OS Installation and Startup Service
- HP StorageWorks Disk Array Installation and Startup Service
- HP StorageWorks Enterprise Virtual Array (EVA) Solution Portfolio
- Storage Operations Manager Installation and Startup Service
- HP OpenView Data Protector Implementation Service
- NAS1000 Installation Service

Hardware and Software Implementation Services

The targeted support that customers need to get their storage solution running right — right from the start—is available with a number of hardware and software implementation services.

HP Services professionals can help if your customers:

- Are adopting a new SAN
- Need help implementing a new storage array, backup system, or tape library
- Could profit from specialized storage software configuration expertise
- Want to maximize storage availability or simplify storage management

HP StorageWorks ESL and MSL Tape Libraries Installation and Startup Service

This installation and startup service provides for the installation and implementation of HP StorageWorks ESL (Enterprise Storage Library) and MSL (Midrange Storage Library) products in SAN environments, including the installation of a Fibre Channel Interface Controller.

Cisco MDS Switches Installation Service

HP Installation for Cisco MDS Switches is a service that ensures your customer's Cisco MDS switch is installed according to HP quality standards by a trained service delivery specialist. It verifies that any service prerequisites are met prior to installation and ensures delivery of the service at a mutually scheduled time.

The service provides installation of the product according to the product specifications and includes an orientation that offers an overview of the product features and includes a question-and-answer session with the service specialist.

HP StorageWorks Secure Fabric OS Installation and Startup Service

The HP StorageWorks Secure Fabric OS Installation and Startup Service provides for implementation of a SAN security strategy, using the HP StorageWorks Secure Fabric OS software. The service can only be delivered for SANs using Brocade-based switches.

The service is sold in a scaled manner, based on the number and type of switches in the customer's SAN. Small SANs might involve only a single day of delivery effort, while larger SANs could involve 5 to 10 days of an engineer's time.

HP StorageWorks Disk Array Installation and Startup Service

Proper installation of storage hardware is crucial to help realize the maximum return on customer storage investments. Complementing new HP StorageWorks arrays, the HP Installation and Startup service provides the necessary activities required to deploy the disk array into operation.

With the assistance of the customer's designated IT storage administrator, an HP certified service specialist will engage in a discovery process designed to help HP understand the customer's business and storage application needs. This collaboration provides the groundwork to plan, design, and employ a customized storage array configuration. The HP certified service specialist will then apply the customer-approved configuration and perform a suite of installation verification tests.

HP StorageWorks Enterprise Virtual Array (EVA) Solution Portfolio

HP provides tailored combinations of technology and services to help ensure the effectiveness of a customer deployment and ongoing support for their storage array. With the HP StorageWorks Enterprise Virtual Array (EVA), the customer can choose from the following service solutions:

- Foundation Service
- Proactive Service
- Enhanced Proactive Service

Storage Operations Manager Installation and Startup Service

HP OpenView Storage Operations Manager (SOM) is an efficient and robust EVA array and SAN management solution. It provides a central management console from which EVA arrays are automatically discovered, mapped, monitored, maintained, and configured along with:

- Heterogeneous storage including infrastructure (switches, HBAs, bridges)
- Direct attached storage
- Networked Attached Storage
- Tape storage devices

HP OpenView Storage Operations Manager combines EVA array management with Command View EVA v3.1 and heterogeneous SAN management with HP OpenView Storage Node Manager into a single orderable product with consistent capacity-based licensing.

HP OpenView Data Protector Implementation Service

HP OpenView Data Protector Implementation Service provides expert assistance with installation, configuration, and system customization. Collaborating with the customer's IT staff, an HP technical consultant—a specialist in storage management—will recommend a backup design by reviewing the customer's system architecture, network connectivity, system configurations, data center, and backup environment, as well as their business requirements.

The HP technical consultant will install, configure, and verify HP Data Protector based on this design. As a final step, the HP consultant will provide a delivery worksheet and review the configuration and functionality of HP Data Protector with their network manager and designated IT staff.

NAS Installation Service

Implementing an HP network attached storage solution can be a daunting task for customers. It requires specialized expertise and in-depth knowledge in areas such as infrastructure deployment, enterprise storage systems, and storage consolidation. Yet a carefully designed and properly installed, configured, and integrated NAS environment is essential for managing critical data and making it readily available to users and applications.

Have your customers partner with HP Services to get their NAS solution up-and-running rapidly, efficiently, and with minimal disruption of their technology environment and their business operations.

Mission Critical Support Services for Storage

- Hardware and Software Implementation Services

Mission Critical Proactive Deliverables for Storage Software

This service adds proactive deliverables to the up-front and contractual mission critical offerings (Priority 24 and Critical Support) for storage software.

Proactive services include: update planning, update assistance, change management, patch management, administration assistance, assessment, and documentation.

The service extends proactive deliverables available for hardware products to storage software and offers the customer more complete coverage and support for mission-critical environment.

Care Pack Support Services for Storage

Care Pack Support Services for Storage provide expert support for your customer's increasingly critical storage solutions.

HP Care Pack Services offer upgraded service levels to extend and expand standard product warranty with easy-to-buy, easy-to-use support packages that help your customers make the most of their storage investments.

Multivendor Environment Support Services for Storage

- Proactive 24 Service for SANs
- Critical Services for SANs
- Business Continuity Services

Proactive 24 Service for SANs

HP Proactive 24 Service for SANs is an integrated hardware and software support solution designed to help customers get more from their IT investment. HP Proactive 24 Service for SANs combines industry-leading technical assistance with proactive account services to cover the entire IT infrastructure and to improve the stability, availability, and operational effectiveness of the IT environment.

HP Proactive 24 Service for SANs enables your customer to leverage HP best practices by providing access to the global technical expertise of HP. An assigned account manager will serve as the customer's primary proactive services contact within the HP support organization and can coordinate additional specialized resources if necessary.

You begin by forming a close working relationship with your customer and by developing an understanding of the customer IT infrastructure and goals in order to help identify gaps in supportability. Subsequently, you meet with your customer twice a year to help ensure ongoing goal alignment and fulfillment of their needs.

Critical Services for SANs

With HP Critical Service for SANs, a team of HP Services experts works closely with your customers to analyze their SAN environment and maximize their SAN availability. The customer SAN is thoroughly assessed for supportability. Configuration details and a topology map are recorded and used to assist in fault isolation, daily operation, and planning for future growth. In addition, the HP team helps customers with firmware upgrade planning and implementation, as well as change management planning. Remote monitoring and configuration tracking using secure, real-time tools including the HP Instant Support Enterprise Edition (ISEE) Advanced Configuration framework give customers an early warning of emerging SAN problems.

Your customer's proactive support can also include a 100% SAN interconnectivity guarantee. And, if your customers contract for Critical Service coverage for HP StorageWorks XP storage, they can take advantage of a 100% data accessibility guarantee as well.

Business Continuity Services

Your customers need to protect their vital business processes against crippling service interruptions. Today, any amount of IT downtime can mean lost productivity, lost revenue, lost customers, and lost opportunities. HP provides proven strategies, services, and technologies to reduce your customers' exposure and vulnerability, help protect their mission-critical operations against diverse downtime threats, and ease their recovery if an unforeseeable catastrophe strikes.

Storage Management Services

- Data Sanitization Service
- Storage on Demand Solution Services
- Technical Services

Data Sanitization Service

The HP Data Sanitization service safeguards confidential business information as the IT infrastructure evolves. Customers are able to maintain increased control of confidential information to the end of its life cycle.

The service is designed to eliminate the possibility that sensitive data can be retrieved or reconstructed from de-commissioned storage devices. It addresses this potentially serious yet often overlooked security risk by removing confidential data from hardware after system upgrades, consolidations, and storage platform migrations.

HP is the only vendor that currently provides data sanitization as a standard service offering. The HP Data Sanitization service is available for UNIX and Windows-based computing platforms using HP StorageWorks disk-based storage devices.

Storage on Demand Solution Services

Storage on Demand Solutions from HP give your customers abundant flexibility to provide for planned capacity, as well as adjust capacity to support changing business needs. The solutions address their needs for instant capacity, metered capacity, and managed capacity.

HP Instant Capacity for Storage offers preinstalled reserved storage capacity that makes planning for future storage growth easier than ever. Your customers will not have to pay for reserve capacity until they need it. When they need extra capacity, they just start using it. HP will invoice them at the end of up to a four-month period, with no subscription fee. What's more, your customer's storage investment is fully protected because they always have access to the latest technology with each upgrade.

Technical Services

Your customers need to continuously enhance the availability, performance, and security of their critical storage solutions.

Today more than ever before, maintaining storage hardware and software at peak performance levels is vital to your customers' business success. Rely on HP Services storage specialists to help your customers prevent problems, defuse downtime risks, and continuously tune performance and increase availability for the highest possible return on storage investments.

HP offers a full portfolio of proactive Technical Services tailorable to your customer's unique requirements.

Storage Education Services

Complementing the extensive HP solutions for storage, HP Education Services offers an innovative program to help storage technicians work smarter.

HP Education Services has developed a portfolio of storage courses for HP storage hardware and software, using a blended approach of combining classroom and online delivery for maximum learning effectiveness and flexibility.

Customer benefits of Network Storage Services

Customer surveys point out the following benefits offered by HP and HP storage service providers:

- Knowledge of environment
- Experienced professionals
- Proactive 24x7 support
- Fast response time
- Sensitivity to business needs and pressures
- Problem avoidance
- High availability priority
- Customizable features
- Single point of contact
- Integrated support for storage, servers, networks

Summary

- Optimize customers' storage infrastructures with HP services to win with business agility
 - Business agility is a competitive advantage
 - ◆ Makes it easier...
 - ◆ Cuts time needed...
 - ◆ Expands ability...
...to harness change for success
 - Make storage work for its customers
 - ◆ Cut costs
 - ◆ Cut downtime
 - ◆ Speed time to market
 - Increase return on IT
 - ◆ Improve business efficiency, continuity, and results
- World class network storage services
 - Solution services
 - Architecture design
 - Data archiving
 - Education
 - Deployment
 - Migration services
 - Care Packs
 - Mission critical
 - Multivendor
 - Optimization assessment
 - Management
- Service partners
- Growing customer base

Learning check

1. When meeting with a customer, there are many reasons why the customer would need and want Network Storage Services to support his or her storage requirements. Select two of these business reasons from the list below. Select **two**.
 - a. Industry trend of outsourcing IT operations
 - b. Control costs while enhancing their ability to maintain change
 - c. Optimized application performance, agility, availability, and efficiency
 - d. Maintaining a staff with storage services skills inside their company has the lowest risk and costs
2. Which three of the following describe the HP Network Storage Services Group's (NSSv) value proposition? Select **three**.
 - a. Cut operational costs
 - b. Cut downtime
 - c. Define role of IT organization
 - d. Speed time to market
3. HP Care Pack support services are positioned for which stages within a customer's storage services life cycle?
 - a. Design stage
 - b. Build and integrate stages
 - c. Integrate and manage stages
 - d. Manage and evolve stages
4. Storage Business Value Workshop and Storage Investment Justification Service are included in which of the following HP storage services groups?
 - a. Storage Solution Services
 - b. Strategic Storage Consulting Services
 - c. Storage Architecture Design Services
 - d. Storage Deployment Services

Objectives

After completing this module, students should be able to:

- Identify main competitors in the enterprise storage marketplace
- Describe HP storage competitors utilizing S.W.O.T. analysis

Overview

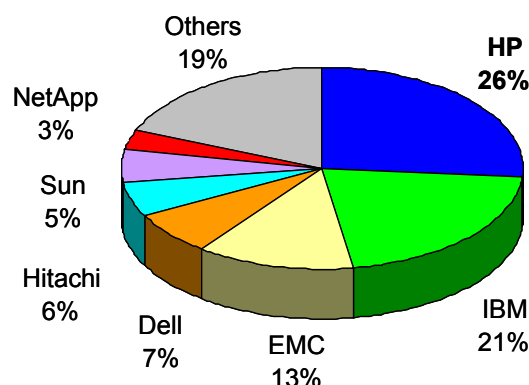
What is the competitive landscape from a business perspective?

This module provides a brief overview of key HP enterprise storage competitors:

- EMC
- IBM
- Sun Microsystems
- Dell

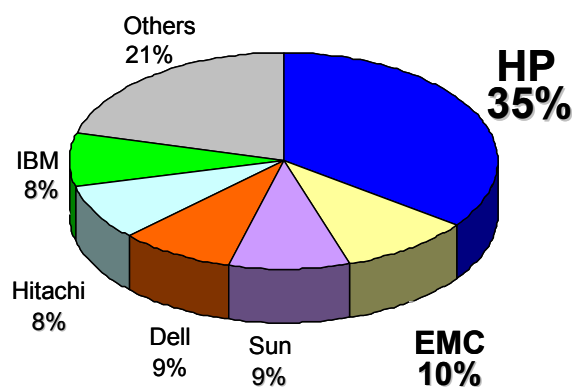
- With \$1.3B of sales in the third quarter of 2003, HP remains the #1 storage vendor with 26.4% share in the total disk storage market.
- HP continues to lead IBM by more than 5 percentage points and EMC by more than 13 percentage points.

**Worldwide disk storage market systems
Revenue market share, 3Q03**



- HP continues to be the world's #1 supplier of SAN-attached external RAID arrays with more than 19,100 units shipped in 2002.
- HP sold more production SANs than its three nearest competitors combined, accounting for 35% of the market.
- HP shipped more than 3 times what EMC shipped in the same period.

**Worldwide Open SAN market share
(units), 2002**



Dell

Strengths

- Partnerships allow Dell to drive technology transition
- Point-of-sale and customer information database
- Strong brand recognition and packaging solutions
- Manufacturing efficiency paired with broad use of Internet to maximize efficiency and minimize cost
- Continued segmentation of markets enables the company to increase its focus as expansion continues
- Excellent reputation and high customer satisfaction rating
- Outstanding capital management allows Dell to earn on cost of capital return with an operating margin of less than 1%

Weaknesses

- Decelerating PC revenue growth rate paired with slow execution of external storage strategy
- Diverging attention and resources to grow home electronics market
- Slow transition of revenue mix to greater percentage of enterprise products revenue and beyond-the-box revenue
- Slow penetration of service provider market and over reliance on third-party service partners
- Low product differentiation caused by low R&D
- Lack of long-term stability in product and technology partnership

Opportunities

- Partnership with EMC could dramatically improve Dell's credibility in the enterprise space
- Growing understanding and experience in storage manufacturing and design with CX200
- Possibility to grow storage sales at 2-3x market rate
- Alliance with MSFT could further strengthen its storage position in Windows NT/2000 operating systems
- Opportunity to acquire a service company, if Dell wishes to move into the provision of professional services and eventually into systems integration
- Quicker rebound after PC sales/upgrade returns
- Low share outside of U.S. offers opportunity for growth

Threats

- As competitors refine their direct sales model, Dell may lose its competitive advantage over time
- Lack of R&D spending might hinder the success of long-term storage success, especially in enterprise space
- Continued uncertainty may hinder Dell's potential growth in the market
- Low-end and mid-range products, along with aggressive pricing might not generate enough top line growth
- Lack of adoption of online buying in EMEA could hamper Dell's expansion in that region
- EMC entering mid- and low-end NAS market with MSFT partnership and NetWin 200 competes with PowerVault NAS

In 2002, Dell signed a partnership with EMC. This partnership gave Dell the right to independently build and market the CLARiiON CX storage systems. These new storage systems will carry the Dell/EMC badge, but the underlying question is, "How will Dell market these storage systems?"

Traditionally, the salesforce's knowledge has been limited to building PCs and servers for its customer. The knowledge needed to sell enterprise solutions will likely overwhelm a typical Dell salesperson.

A major concern for customers will be the type of services being offered by the vendor to support these storage systems. If Dell relies on outsourcing its consulting and services divisions to other vendors like EMC, it will find itself with partners who have no vested interest in furthering its enterprise agenda.

Dell may be burdened with developing its own in-house professional services organization that can support the enterprise solutions it sells. This new undertaking is an added expense that Dell will have to incur if it wants to grow its market share for enterprise solution selling. The Dell model for services may resonate satisfactorily for SMB accounts but is not being accepted in most enterprise accounts.

EMC

Strengths

- Market share leadership in mainframe and enterprise storage markets and high awareness of it among end-users
- Completely refreshed product portfolio positions EMC to regain lost share
- High-margin storage management software business
- Reputation for industry-leading customer service and product quality
- Largest R&D investment in the industry to stay ahead of the competition plus a strong cash position allows further software technology acquisitions

Weaknesses

- Increasing competition in enterprise and mid-range storage market
- Lack of success in leveraging reseller community for midrange storage sales
- Low penetration of international market limits geographical revenue diversity
- Severe hardware price decline increases dependency on software and services revenue
- Dependency on Global 2000 revenue and not enough revenue coming from the SMBs

Opportunities

- Fixed content market continues to be an opportunity for EMC's Centra product line
- Market share to be captured in the mid-range storage market with CLAR iiON and using Dell as the channel
- CLAR iiON manufacturing could be completely outsourced to reduce overhead and enable EMC to focus on core software business
- Legato's product portfolio and customer base should be leverage to grow software revenue
- FICON support and the return of mainframe market can be target markets for the DMX

Threats

- Competitions continues to boost storage system performance and drive down prices to hurt EMC's technology leadership and margins
- Increased competition in the SAN and storage consolidation market could drive software prices and margins lower
- Capable, high-end CLAR iiON systems could cannibalize Symmetrix sales
- Uncertain economic forecast and slow IT spending rebound could dampen EMC's hope for a fast revenue ramping by its new DMX line

The economy has forced businesses to make drastic reductions in their IT budgets. As revenue declines, customers have to do more with less. Many storage hardware vendors, including EMC, are struggling to generate revenue and are watching their stock value tumble.

EMC recognizes that the business landscape has changed. It must increase its revenue stream from storage management software, because managing the storage infrastructure is where customers are having the biggest challenges.

Storage vendors must provide a storage solution that ideally should encompass hardware, software, and professional services. IT customers are putting the hardware vendors on notice that they want to be able to manage true heterogeneous environments within their business and IT environments. EMC has tried to influence the IT community with its WideSky initiative, which is basically a private API swap between vendors. However, other hardware vendors such as IBM, HP, and Sun are adopting a more open model from the Storage Networking Industry Association (SNIA) called the Common Information Model (CIM).

Sun

Strengths

- Established technology leader with the vision to see and develop new computing paradigm
- Technology excellence with R & D commitment to be the technology leader in the market
- Ability to leverage acquisition and alliances quickly
- Leadership in the RISC/UNIX server and workstation technology
- Ability to drive service revenue growth along with new server and storage introduction

Weaknesses

- Unspectacular image as a storage provider
- Weak storage sales outside of Sun server base
- Weak business solutions offering despite a solid product line
- Shaky financial model in tough economic condition
- Intense competition in the low-end server market
- Questionable commitment to Linux, when compared to competitors

Opportunities

- Sun finally has the complete storage hardware portfolio to complement its wide range of acquired software packages
- The Pirus acquisition enables Sun to have bigger presence in the SAN-based storage mgmt market
- Significant partnerships and potential in the wireless market for all of Sun's products to sell into
- Solutions offering and approach is growing and gaining traction

Threats

- Wintel server, storage are encroaching into Unix/Solaris space
- Lower-cost Linux solutions from major vendors
- The emerging perception of a niche player could induce customers' reluctance to buy Sun products
- Significant partners or channels could get acquired due to market consolidation
- Dell/Oracle partnership could hurt database sales for server, storage, solutions and services

Sun's servers remain the primary focus and revenue stream for the company. Due to the arrival of competitive high-end UNIX server products, Sun is spending the majority of its time selling in a market where its advantage and customer demand are slipping. In short, Sun's storage strategy is to attach big Sun storage to big Sun servers, generating the most revenue possible and protecting the company from EMC.

It is most likely that you will only see Sun when your customer calls them to bid on a potential UNIX opportunity. When Sun does come, it will present its storage story as a complement to its servers, but it is not likely to lead with storage for the whole company.

By some estimates, between 50% and 80% of Sun E10000 servers have EMC Symmetrix storage attached. Sun's attempt at building a strong storage strategy was designed to stem the rush of their customers to EMC. Five years later, Sun is not any better off than before their announcement. While storage is one of the hottest growth areas in the industry, EMC remains a constant threat to high-end Sun installations. Of the \$40 billion in 2000 total storage revenue, Sun garnered less than 10%.

The flaws in Sun's overall storage strategy are numerous.

1. First, there is the issue of control. Sun depends heavily on third-party manufacturers for critical components of its overall product offerings.
2. Second, Sun's products do not represent an integrated product family. The only way for a customer to migrate from one product family to another is by a forklift upgrade.
3. The third issue is software, which is probably Sun's largest weak spot. Even after Sun introduced the 'T3' storage product family in 2000, storage analysts did not promote it as a storage solution. For example, the T3 storage was not certified to run under Sun's own high-availability clustering software for nearly 2 years. The real power of any storage strategy is in the ability to provide the high-end features that high-end customers demand.

In order to compete more effectively with EMC at the high end, Sun signed an agreement with Hitachi Data Systems in August 2001 that allows Sun to distribute the HDS 9900 family of storage solutions. This move fills the gap, but further fragments Sun's overall strategy by adding another storage vendor into its product mix.

All industry leaders can provide high-end customers with the ability to quickly clone data, create data snapshots, and perform remote replication of data for high availability as well as additional security measures. Sun has yet to implement many of these features. Additionally, Sun lacks a single product management strategy that can manage the operations of their entire product family.

IBM

Strengths

- Enhanced Shark storage is more competitive
- Breadth and depth of storage offerings
- Revitalized focus on storage business — IBM total storage
- Aggressive (p/p — portfolio price their solutions) competitive
- Large mainframe and AIX connect base
- ISV partnerships — Veritas and others
- Can provide a total end-to-end solution

Weaknesses

- Trying to overcome “Shark’s” poor reputation
- Intense competition from EMC and HDS
- Recently sold disk drive business to Hitachi
- Less performance, scalability, and density on Shark
- Lower availability + investment protection
- Lost much of its installed base DAS to EMC
- Late to the market with SAN and playing catch-up
- Low connect rates to non-IBM environments

Opportunities

- Improved business model under new CEO
- Anticipated growth in international markets, especially A/P
- Continue to push bundled solutions
- Aggressively promote brand with attributes of quality, reliability, and innovation
- Computing-on-demand applications, especially for life sciences and research entities
- Grow market share through partnered solutions
- Focus on mid-range and SMB market space

Threats

- Competitive alliances in storage, software, services
- Pricing and margin erosion
- Uncertain economic forecast and IT spending rebound
- Traditional lack of focus on the SMB space
- Backlash of some customers against network computing vision

Do not underestimate IBM in a competitive situation. IBM has undergone considerable reorganization and redefinition in order to rebuild itself into a position of competitiveness. Its financial resources are virtually unmatched and its overall business is strong.

However, IBM is still weak in its storage product line, although it is quickly building up strength. IBM uses OEMs for a majority of its entry to mid-level storage products, including all of the FAST series of products and EXP disk enclosures. Its Enterprise Storage Server (ESS, also known as “Shark”) product line had reliability issues in its first generation. While those issues have been recently addressed, its back-end technology is still IBM’s proprietary Serial Storage Architecture (SSA). SSA technology lags behind the rest of the storage industry in development, and IBM has shown signs of decommitting to any further SSA development. This leaves a question regarding Shark’s next generation and its underlying technology.

StorageTek

Strengths

- Primary focus on tape and tape automation, especially for the mainframe environment
- Well regarded products in terms of performance and interoperability
- High R&D as percent of sales underlies ability to develop technology in-house
- Strong international presence
- Solid partnerships with indirect channel partners to drive revenue
- Solid balance sheet with significant cash flow

Weaknesses

- Company culture is recovering from complacency and restructuring effects
- Direct sales organization (especially in NA) has experienced high turnover and is having to rehire and ramp up knowledge base
- SAN strategy not fully developed or communicated
- Disk subsystems business is still volatile and not a reliable revenue source
- Small consulting services business — no critical mass (90% of services revenue is hardware maintenance)

Opportunities

- Growth in disk product and SAN solution segments
- Ability to leverage international presence in high-growth regions (Asia, E. Europe)
- Growth in consulting service arrangements with customers could provide additional revenue streams
- Continued performance improvements for products in client/server environment
- Integrated solution sales with software/hardware partners
- Focus on storage management software as part of automated solution

Threats

- Increased competition and pricing pressure in disk products could have negative effect on STK's growth in this market
- Continued economic slowdown, particularly on a worldwide basis
- Commoditization of tape business and its impact on the sustainability of large in-house R&D
- Serious threat from midrange tape technologies (LTO, SDLT, AIT)
- Loss of HP as OEM partner will force STK to fight for existing accounts

Resources

- Competitive Intelligence website
<http://nss.esgonline.hp.com/CI/index.htm> (internal)
- Storage Competitive Tracker
http://business.hp.com/sales/competitivesales/sales_trackers.htm
- Competitive profiles
<http://as.ideascp.com/cp/register.aspx?t=%2fcp%2fcp.aspx%3flid%3df64-f19b181bbf5b%26cookietest%3dYes&lid=f64-f19b181bbf5b> (internal)
- Partner briefing rooms (sign up on partner web)
<http://www.hpbriefingroom.com/>

Summary

- The market leaders are viewed as follows:
 - **EMC** — Enterprise, revenue
 - **IBM** — Technology, size matters
 - **Sun** — Focused, scrappy marketer
 - **HP** — Volume, revenue
 - **Dell** — Price, PC clout
- Everyone has parts
- Not all leaders are created equal

Learning check

1. HP has shipped more than the following percentage of the all the worldwide Open SANs during 2002:
 - a. 20%
 - b. 35%
 - c. 50%
 - d. 15%
2. Most of Sun's enterprise servers have high-end arrays as their mainstream attached product sold by
 - a. HP
 - b. Sun
 - c. IBM
 - d. EMC
3. IBM's high-end storage array is called
 - a. TSA
 - b. Shark
 - c. XEP
 - d. Enterprise Array Storage
4. Dell relies on its service business to make its profit on storage sales
 - ☐ True
 - ☐ False
5. Dell has a storage reseller agreement with
 - a. IBM
 - b. Sun
 - c. EMC
 - d. HP

Enterprise storage selling tools and resources

Module 18

Objectives

After completing this module, students should be able to:

- Describe the resources available to assist in selling, supporting, and servicing HP enterprise class storage solutions.
- Identify the primary tools used in configuring enterprise class storage solutions.

HP.com

<http://www.hp.com>

This website provides general information on:

- Products and support (including storage)
- Services
- Solutions for vertical markets
- Worldwide office locations
- Online purchasing

HP partnership web

If you are **already** a partner, access the following password-protected website:

<https://partner.americas.hp.com>

The following website helps authorized partners locate specific information regarding the selling of HP-related products and services:

https://partner.americas.hp.com/rrc/performance/html_src/index/index.htm

The following website is for Asia Pacific partners:

<https://www.pol.hp.com>

HP StorageWorks

For information about the complete family of HP storage solutions:

<https://www.hp.com/go/storage>

HP NSS Knowledge Management Tools (KMTs)

Self-paced web-based sales training that focuses on specific storage solutions, market opportunities, configurations, competition, and selling tips.

Internal:

<http://nsscat.corp.hp.com/curriculum-sales.htm>

External:

https://partner.americas.hp.com/rrc/performance/html_src/train/c_web_based_train.html#anc15

HP Services

HP Services is a global business and IT integrator. HP offers enterprise-level consulting services and solutions for value creation and innovation. HP Consulting provides all the underlying process, application, technology, and infrastructure consulting services throughout the complete business integration services lifecycle.

Internal:

<http://services.inet.cpqcorp.net/nssv/>

External:

<http://www.hp.com/hps>

Resellers:

https://partner.americas.hp.com/rrc/performance/html_src/channel/programs/sales.htm

HP Care Pack services

The new HP Care Pack offerings are “up-front” or “prepaid” services, generally purchased at the time of product sale. The packages are sold through the direct, indirect, and Web sales channels.

In support of a single brand and service program, a new global HP Care Pack name and image replace both the classic Compaq CarePak and HP Supportpack brands. This name and image will be phased in over the first half of 2003 as the new portfolio is released. However, Compaq CarePak and HP Supportpack part numbers will remain unchanged at this time.

When an HP Care Pack part number is requested for transactions, enter the appropriate pre-merger company’s number. HP partners are being given an early preview of this through HP CSN to ensure that they have adequate time to prepare their businesses for the transition.

<http://www.hp.com/hps/carepack>

Managed storage solution

A segment of Professional Services provides a flexible leased managed storage solution that allows multivendor storage support, the ability to increase or decrease storage as needed, and online storage provisioning.

Internal:

http://cs.services.hp.com/cod/capacity/cod_managed_storage.asp

External:

www.hp.com/large/infrastructure/utilitycomputing

HP Financial Services

HP Financial Services (HFS) helps technology users in every HP customer segment make the most of their IT investment. From acquire to retire, the financing and financial asset management tools provide affordable solutions to customers' IT needs. HFS also provides a wide range of remarketing services to maximize the value of older equipment.

<http://www.hp.com/hpfinancialservices/default.html>

Literature order system

You can use one of the following for ordering HP product and marketing literature:

Americas/Europe/Asia:

<http://www.webfulfillment.com/kpCorp/lit/index.asp>

In the Americas, call 800-333-7885

HP NSS enterprise storage battle table

Access the following for a web based software package that give a comparison amongst leading competitors of HP Storage Products. Provides comparisons of sales issues as well as an organized view of similar technologies.

<http://hp.winner.winonline.cc/noaccess.cfm>

Storage solutions

Pretested storage solutions are available that are completely profiled, tested, and all the part numbers included to give a validated solution.

Internal:

http://storage.inet.cpqcorp.net/application/view/menu_products.asp?pf=1

Partners:

<http://h18006.www1.hp.com/storage/solutions.html>

S.P.O.C.K.

SPOCK (Single Point of Configuration Knowledge) provides a mix of validated storage configurations, guidelines, and hints on a variety of HP storage solutions.

Internal:

<http://turbo.rose.hp.com/spock>

Network Storage Solutions configuration information

Verified preconfigured storage array and tape solutions:

https://partner.americas.hp.com/rrc/performance/html_src/configurator/config.htm

Verified pre-configured SAN solutions:

<http://h18000.www1.hp.com/products/storageworks/san/documentation.html>

Cross-industry preconfigured solutions index (combines storage and other products):

http://h18000.www1.hp.com/solutions/index_crossindustry.html

Network Storage Services world wide contacts

Internal:

http://cs.services.hp.com/nssv/sales_guide/nssv%20contacts.doc

SalesBUILDER for Windows

SalesBUILDER for Windows (SBW) is a configuration/quoting tool that automates the configuration and pricing of HP products to reduce the time and complications of using manual look-up configuration guides. SBW is a portable, PC-based application software that has a fast configuration turnaround and menu-driven configuration choices. SBW rules-based configuration checking assures only valid configurations. New storage solutions are added to the tool on an ongoing basis.

SBW enables you to:

- Configure new systems, configure storage-centric solutions, upgrade, and add on to existing systems
- View system diagrams, make modifications, and add individual products from the Parts List
- Prepare budgetary quotes independently on a PC
- Send files to other SBW users or export files to other PC applications such as Word and Excel

Internal:

<http://sbw.cup.hp.com/>

Resellers:

https://www.tools.hp.com/dpc_jsp/sbw.jsp?appid=SBW

SAN Design Guide

This guide helps salespeople become more familiar with the components of a SAN when designing a SAN for customer needs including:

- Architecture
- Configurations
- Implementation
- New technologies

Internal:

<http://h18006.www1.hp.com/products/storageworks/san/documentation.html>

NSS Sizer

The NSS Sizer is a downloadable sizing tool that enables you to work with your customers to design a storage infrastructure to meet their needs. Whether they have performance requirements with specific metrics they need to meet, if they have business requirements such as server consolidation, or if they have pure capacity requirements, you can define that information in the NSS Sizing Tool and because the tool applies all of HP's SAN design rules, it will give you a valid, supported storage infrastructure to meet those requirements. Use a Sizer when you are not sure what the best combination of products are to satisfy your customers requirements and you want to try different scenarios.

A helpful wizard interface guides the user through the process of sizing a SAN by asking a series of questions about the proposed configuration and are thus intended for use by those with less experience using the Sizer.

NSS Sizer is now available for download and includes these features:

- Product and Price Updates for the September 30th Launch (Nile).
- New EVA Services Portfolio
- New HP Services Portfolio
- Backup Sizing, SAN and DAS. Integration of StorageWorks Backup Sizing Tool V4.0
- Business Copy Sizing, Snap and Clone reserve space
- Best fit for EVA 3000/5000 submodels (2D, 6D, 12D, etc)
- Parts/Pricing Updates for these countries:
 - the United States, the United Kingdom, Canada, Australia, Singapore, New Zealand
 - Sweden, Denmark, Norway, Finland, Germany, Austria, France
 - Spain, Italy, Netherlands, Japan, China, Hong Kong
 - Belgium, the Czech Republic, Poland, Russia, Switzerland
 - HP GSA Pricing for "US Federal Government" and other agencies
- Downloadable - can operate when disconnected from the net.
- Smart Update Technology - tools and data kept current via automatic downloads when on-line.
- Partner Training PowerPoint presentation in the download area.
- Frequently Asked Questions (FAQ) available

The NSS Sizer tool website can be accessed at:

<http://hp.com/go/nssSizer>

HP StorageWorks Enterprise Backup Solution Tools

Collateral for the EBS solution (libraries, operating systems, arrays, switches, servers, Fibre Channel and SCSI host bus adapters and more) is available at the following URL:

<http://www.hp.com/go/ebs>

HP StorageWorks OpenView Data Protector

Collateral for the Data Protector solution is available at the following URL:

<http://www.hp.com/go/dataprotector>

Business value model for storage

The business value model examines a customer's current storage approach and growth projections and provides an ROI study to help develop a financial business case to move to a HP storage solution.

<http://nss.esgonline.hp.com/marketing/wwsalessupport/bvmodel/>

Partners should contact Bob.Jefferson@hp.com.

Storage proposal website

The storage proposal website contains a comprehensive inventory of preformatted customer proposals and a tutorial on developing customer proposals.

Americas, internal:

<http://proposalweb.fc.hp.com/Solution/Storage2.htm>

Europe, internal:

<http://tco.portal@www.hpproposal.com/proposal/start.asp>

Storage Networking Industry Association (SNIA)

The SNIA Technology Center, located in Colorado Springs, CO, hosts programs that accelerate the development and introduction of advanced network storage technologies and solutions. Contact them at:

<http://www.snia.org/home>

HP sales tools — one-stop shopping

The HP sales tools provide comprehensive integrated page lookup of all of the key sales programs, product information, and so forth.

<http://esp.mayfield.hp.com:2000/nav24/srs/> (Internal)

SMI-S developers program

The goal of the HP Storage Management Interface Specification (SMI-S) Developers Program is to accelerate the adoption of SMI-S-based solutions that simplify the interoperability challenges developers face in building storage solutions, thus streamlining management of multivendor network storage. Open to qualified HP partners, program membership today includes AppIQ, BMC Software, CreekPath Systems, Storability Software and VERITAS Software.

<http://www.hp.com/dspp>

Customer focused testing team

Strategic CFT creates a partnership between NSS and the customer that delivers significant value to the customer while clearly differentiating HP. The strategic partnership is based on a simulation of the customer's environment, leveraging the customer's existing or initial purchased configuration. A mutually agreed upon 9 to 12 month collaboration and test plan is developed between the CFT team and the customer. The strategic partnership also requires a clear understanding of the HP revenue potential.

Application-based CFT engagements focus on integrating customer applications such as Microsoft Exchange, Microsoft SQL Server, Oracle, SAP, and Lotus Domino with HP server, HP storage, and 3rd party configurations. All application-based CFT engagements are validated by customer demand. These can include operational demonstrations, performance benchmarking and information to support bid requests

<http://nss.esgonline.hp.com/marketing/wwsalessupport/cft/index.htm>

CSPS technical portal

The CSPS technical portal is a comprehensive integrated portal of all key information for technical support teams aiding internal sales.

<http://tech.portal.hp.com/portal>

Partner sales tool kit

The partner sales tool kit is a comprehensive one-page partner website to help partners find all key sales information.

https://partner.americas.hp.com/rrc/performance/html_src/toolkit/salesmkt_toolkit.htm

Learning check

1. What is the name given to HP packaged services?
 - a. HP ServiceCall
 - b. HP SupportPack
 - c. HP Care Pack
 - d. HP Prepaid Services
2. Which resource provides partners with a secure website that allows access to key information as well as an avenue to communicate with HP via email?
 - a. HP Global Services
 - b. HP Business Link
 - c. HP Partnership Web
 - d. HP Storage Resource Center
3. What tool automates the configuration and pricing of storage systems?
 - a. CarePaq configuration kit
 - b. SalesBUILDER for Windows
 - c. HP configuration tool
 - d. Network Storage Configuration Tool
4. What tool would you use to assist in designing a storage area network?
 - a. HP StorageWorks tool
 - b. HP Network Design utility
 - c. HP SAN Sizer
 - d. SalesBUILDER for Windows
5. Where can you go to find out about leasing services?
 - a. HP StorageWorks tool
 - b. HP Financial Services
 - c. HP SAN Sizer
 - d. HP Network Design utility

Storage Selling Competencies

Over the past year, an extensive effort has been made to define the stages of work done by HP sellers (both direct and partners) to identify and address customer needs. These stages of work can be compared to a sales cycle or process. Although the length of sales cycles differs and the various activities that are conducted can be modified to meet specific customer needs and selling situations, the overall stages of the cycle are as follows:

Stage	Description
Stage 1. Establish Relationships	This is the first stage that sellers typically go through with new opportunities to establish key relationships with decision-makers and to understand the “playing-field” or sales situations.
Stage 2. Educate Customer and Assess Business Needs	<p>The seller educates the customer about storage and identifies the business needs for storage. This stage may be the most important phase of the sales process. The care, accuracy, and completeness with which this stage is completed will affect:</p> <ul style="list-style-type: none">■ The time and likelihood of closing business■ The ability of sellers to demonstrate and deliver value to the customer■ The likelihood that the customer will purchasing the right solution for their unique needs <p>Success at this stage will also have a long-term effect on customer satisfaction and the likelihood that the customer will purchase products or service from HP again.</p>
Stage 3. Assess Technical Needs	Together with system engineering resources, the seller thoroughly investigates the customer’s technical environment to determine performance, technical, application, and implementation needs.
Stage 4. Demonstrate Capabilities	The seller demonstrates the capabilities of HP Network Storage Systems by presenting a solution that will meet the present and future needs of the customer, and by sending a proposal.
Stage 5. Obtain Commitment	The seller obtains commitment from the customer. The completion of this stage means that the business has been won. Many people interviewed in the recently completed analysis described this stage as “when the true selling begins.”
Stage 6. Maintain Relationships	The seller ensures that the customer’s needs are always met and that the customer can continue to find increased value in HP solutions and services. The maintenance of customer relationships is a critical component of successful selling.

Points to Consider when Selling Enterprise Class Solutions

Although the six stages of the sales cycle are all relevant to the sale of storage solutions in the enterprise class market, several activities within each stage deserve special attention.

Stage 1. Establish Relationships

In your efforts to establish and develop relationships in the first phase of the process, keep the following activities in mind:

- **Leverage existing relationships** — Try to identify and gain the support of any people in the account with whom you have worked or who have provided support in the past. Gain the support you need to help you understand and address new opportunities or develop additional credibility for your work on existing opportunities.
- **Determine decision makers** — Develop an understanding of all the individuals who have a potential impact on your selling efforts, and be sure to identify the individuals who have the authority to make the decisions that affect your selling efforts.
- **Prepare and rehearse questions** — Review the information you have and compare it to the information you believe you need to have. Then, develop the appropriate questions you need to obtain the information you don't have or that will help explain aspects of the situation and needs that the customer does not currently understand.
- **Determine sources of information** — Identify the best places to get the information you need that is accurate and will add credibility to your efforts.

Stage 2. Educate Customer and Assess Business Needs

Because this stage may be the most important phase of the sales process, keep the following activities in mind:

- **Determine key assessment areas** — Identify the critical aspects of the customer's business operation that are to be addressed by the storage solutions you can provide. Then determine the method you will use to assess these areas. Be sure to involve the customer throughout the process.
- **Identify problems that the customer understands or endures** — Take the time to understand and highlight the problems that your customer understands and continues to endure or accept. Try to point out the implications of such problems and the impact of not addressing them.
- **Assess the cost of problems** — Assess the cost of problems that the customer is facing. Determine costs that result from inefficiencies, lost or inaccessible data, faulty or outdated equipment, and so forth. If possible, provide a sense of the cost savings or additional revenue that the customer can achieve by successfully addressing problems.

- **Explain what customers need to know** — Develop the customer's sense of your own value by providing perspectives, information, and resources that the customer needs and does not have.

Stage 3. Assess Technical Needs

As you are determining the customer's performance, technical, application, and implementation needs, keep the following activities in mind:

- **Investigate and inquire about quality** — Quality issues provide a good starting point and a useful context for any assessments of technical needs. When you make inquiries about quality, many issues related to the availability of data and the operation of existing storage systems will come to light.
- **Talk with technical contacts** — Identify the individuals who have an important role or perspective on the customer's technical operations. These people can help identify needs and provide information about any efforts that are being made to address these needs.
- **Prepare a solution and make technical recommendations** — Using the information that has been developed about existing technical needs, provide the customer with your best sense of how to address these needs with HP storage products and solutions. Give the customer sound technical recommendations and allow him or her to react to the recommendations, and to think about aspects of needs that he or she may not have considered.

Stage 4. Demonstrate Capabilities

When you are preparing to present the solution to your customer, keep the following activities in mind:

- **Determine how best to use internal resources** — Your use of resources can be pivotal in gaining the customer's commitment. Consider the full scope of what you want the customer to know and to decide. Identify the potential weak points that need to be addressed, or areas where you need to convey the sense of what HP can do. Then enlist the resources you need and use them in the stages of your selling efforts where they can have the greatest impact.
- **Sources for account references and demo support** — Sometimes a sale can be made by helping the customer understand that similar problems have been addressed successfully, elsewhere. Look for account references and demo support resources that can help your customer see that similar problems have arisen and have been addressed successfully.

Stage 5. Obtain Commitment

Some activities to consider when obtaining the customer's commitment include the following:

- **Prepare and deliver the proposal** — Obtaining the customer's commitment is a gradual process. The work you do in the first phases of the sales process is part of the process of gaining commitment. At the appropriate point, you should prepare a proposal for the customer, articulating what you have learned about the opportunity and describing how you would recommend addressing the customer's needs. Let the customer see clearly what you are proposing, how much it will cost, and what the potential impact the recommended solution.
- **Plan implementation** — The right solution is only part of the process of gaining the customer's commitment and, in the end, having a satisfied customer. As best you can, consider what must be done to successfully implement the solutions that you are recommending and consult with your customer about it. Help your customer develop a successful implementation plan.
- **Anticipate obstacles** — Try to anticipate any obstacles that might arise while you are gaining the customer's commitment. You stand the best chance of doing this if you:
 - Identify the decision-makers in an account.
 - Understand as much as you can about the customer's needs and any efforts that have been made to address those needs.
 - Take the time to learn something about the financial aspects of the sale.

Stage 6. Maintain Relationships

Maintaining a relationship with your customer is a critical component of successful selling. Keep the following in mind:

- **Leverage relationships** — After the sale has been made and the solution has been implemented, you must continue to support and leverage the relationships that you have developed. These relationships will keep you informed about the solution you have helped put in place to ensure continued success. Well-maintained customer relationships can also help you identify additional opportunities in the account or introduce you to other opportunities that are entirely new.
- **Offer the customer a single point of contact and continued education** — Make ongoing communications and any support the customer requires as easy as possible. Be the first person that your customer thinks of when he or she picks up the phone to get answers to new or existing storage problems.
- **Maintain contact** — Stay in touch with your customer. Monitor your customer's situation and needs. Answer questions and keep your customer apprised of advances in the technology of storage solutions.

Summary of the Storage Selling Competencies

Each opportunity is different. Some consist of very short exchanges over the phone. Others involve several stages of contact directly with your customer. Use the stages of the Storage Selling Competencies to organize and guide your selling efforts:

- Complete the activities that will help you learn about your customer's needs and position HP storage solutions most effectively.
- Integrate what you have learned about the storage market and HP's strategies and storage solutions with your selling activities.
- Develop the sense in your customer of the value you bring in helping him or her understand and meet his or her business needs.

And finally, use your account plan in conjunction with the stages of the Storage Selling Competencies to:

- Record, organize, and develop the information you gain about your customer and his or her needs.
- Identify information you need and the steps you will undertake to get the information.
 - Develop the elements of your strategy for establishing business value and gaining your customer's commitment to you and the HP solutions that you can provide.

Sales lead exercise

appendix B

Overview

This appendix includes three student activities:

- World Information Technology
- Technology Centers Ltd.

Depending on the instructions from your instructor:

1. Read the “Situation” and “Key People” sections of the Sales Lead Information.”
2. Select the challenge that will be used from the list provided:
 - Establish Relationships
 - Educate Customer and Assess Business Needs
 - Assess Technical Needs
 - Demonstrate Capabilities
 - Obtain Commitment
 - Maintain Relationships

Note: You can select one, or any combination of Challenges. Remember the amount of work that will be required for the teams to complete each challenge and the time available to debrief their work. Between one and three challenges per exercise is recommended. All the teams will work on the same set of challenges you select.

3. Work with your team and use the worksheet that is in this appendix to answer the challenges that have been assigned.
4. When you have completed work on Part 1, Challenges, turn to the page with Exercise - Part 2, Solutions, and work with your team to consider the components of the solution you’d propose for the sales lead opportunity.

LEAD EXERCISE: WORLD INFORMATION TECHNOLOGY

Instructions: Read the “Situation” information that follows about the opportunity that exists with World Information Technology. Then wait for directions from your instructor concerning your assignments to complete Part 1 of the exercise.

Situation

Company Information: World Information Technology is the premier developer of map databases. The company provides the foundation for location-based applications such as routing, web mapping, emergency response, site selection, risk analysis, and facilities management. With twenty-two years of experience in data management and compilation, WIT brings together myriad data resources to create spatial products and services that help businesses analyze geographic relationships and consumers get to where they want to go. Companies like MapQuest and Microsoft use data extracted from WIT's core database for trip planning, routing, and market analysis. WIT is headquartered in Mansfield, Vermont.

Industry: Developer of Cartography Databases

Business Situation: WIT's success has given rise to a number of business and operational issues that are natural consequences of high growth. At the same time, since the events of 9/11 a number of its products and services have become more mission critical and therefore necessitates additional considerations for addressing them with a minimum of operational interruptions. Finally, with growth and success comes an additional level of financial accountability. As WIT proceeds to review its needs and the solutions that various suppliers can provide, it is doing so with a close eye on cost factors.

Key People and Issues

- **Hugh Moran – CEO:** Hugh joined WIT when the company was in its formative stages and has guided it to the level of success it now enjoys. He is a strategist who helped formulate the market for geographic data and has since kept WIT in a prime position within it. He knows the next level of competitive requirements will include higher levels of accuracy and smaller turn-around windows for the delivery of information.
- **Steven Hagler – Director of Information Technology:** Steven has been with the company since its inception. He has seen it meet a number of significant technological challenges as it has grown and knows that the current set of needs represent yet another such benchmark in the company's history. His chief concerns are addressing the current set of requirements while keeping an eye on potential needs of the future. He knows that if the company is to maintain its healthy competitive position it must stay ahead of the IT curve. Among several other things, he is focused on increasing performance while decreasing the level of IT administration of storage, and on ever-growing capacity requirements.
- **Michelle Bornstein – Chief Financial Officer:** Michelle is a relatively new member of the WIT executive team. While she has worked in high tech companies before she has never worked with a business that was as data-intensive as WIT. She was brought in to help the company manage and meet an ever-growing set of financial requirements and investor expectations. She is frustrated that the cost of ownership of the systems that drive the business seems to be on a never-ending, upward spiral.
- **Raymond Mason – Chief Operations Officer:** Like Steven, Raymond has been with the company since its inception. His concerns bridge technical and financial issues. The company has been very successful to date with the systems it has in place and its operating procedures. Raymond knows, however, that the current challenges will require some re-thinking around the number of people that are required to operate the company's systems and perform associated management functions.
- **Janice Picardi – End-User Support Manager:** Janice reports to Steven. While she shares many of his concerns at the strategic level, her own focus is on some very specific matters such as how to address a constantly increasing size and number of databases when it comes to back-up operations. She is also concerned about the impact of back-up activities on end-user access. At this point in time she has only been able to complete about 60% of the required backups overnight due to conflicting schedules.

EXERCISE – PART 1: CHALLENGES

Your instructor will assign one or more of the stages of the storage selling competency cycle for you to work on with your team. Review any information that is provided for the assigned stages and then develop answers to questions that are provided for the assigned stages. Be prepared to present the results of your team's work.

ESTABLISH RELATIONSHIPS

Questions

- What would you do to try to leverage existing relationships to help you with this account?
- What questions would you prepare and rehearse for your initial meeting with representatives of WIT?

EDUCATE CUSTOMER AND ASSESS BUSINESS NEEDS:

In a hallway conversation you've heard that Michelle Bornstein has had EMC provide a preliminary quote of its new cost sensitive CLARiiON line.

Questions:

- What information about WIT's operation would you want to find out?
- Given that EMC is in the account ahead of you, what tactics would you pursue?

ASSESS TECHNICAL NEEDS:

Questions:

- What do you think you need to know about WIT's technical needs?

DEMONSTRATE CAPABILITIES:

Questions:

- What capabilities do you think will be important to demonstrate to WIT to convince them of HP's ability to address their needs?
- How could you show HP's established track record for addressing similar requirements?

OBTAIN COMMITMENT:

Questions:

- What would be the key points of any proposal you'd prepare for WIT to review?
- How will you address the potential challenge of a lower cost EMC solution?

MAINTAIN RELATIONSHIPS:

Questions:

- If you were to develop an ongoing communications plan for WIT, with whom would you try to stay in touch?
- Why?

EXERCISE – PART 2: SOLUTIONS

Based on the information you have read, and the work you have done in Part 1 of this exercise, what components of a storage solution would you recommend to address the needs of World Information Technology?

RECOMMENDED SOLUTION COMPONENT(S)	COMMENTS

LEAD EXERCISE: TECHNOLOGY CENTERS LTD.

Instructions: Read the “Situation” information that follows about the opportunity that exists with Technology Centers, Ltd. Then wait for directions from your instructor concerning your assignments to complete Part 1 of the exercise.

Situation

Company Information: Technology Centers, Ltd. is a leading retailer in the consumer electronics industry. Its revenue for the past fiscal year exceeded \$9B. The company sells cameras, printers, computers, wireless phones, faxes, stereo systems and electronic games. Technology Centers has more than 620 stores in the US and Canada, and is headquartered in Richmond, Virginia.

Industry: Consumer Retail - Electronics

Business Situation: A significant proportion of Technology Centers’ legacy storage devices are reaching the end of their warranty period. Technology Centers’ own evaluation of the situation has shown that the ongoing cost of maintenance or the extension of the warranty period for the legacy systems would be more than the replacement cost of new storage devices. Many of these devices are made by a competing storage supplier. An assessment of the company’s future needs for storage indicates that increases in both capacity and performance will be required over the next five years. The company has established an evaluation team to review the requirements and draft an RFP for potential suppliers. As a current supplier, HP has received the RFP and you have followed up to develop some initial information about the opportunity. You have a period of two weeks to do any further information gathering and analysis you require. You must then submit your response to the proposal and be prepared to present to the evaluation team.

Key People and Issues

- **Maria Shire – Chief Financial Officer:** Maria has been with the company for the past seven years. She has effectively managed the challenges associated with the growth of the company’s business and has been instrumental in maintaining an unbroken string of year-over-year growth in profitability. She is a tireless worker and good team player. She is on the evaluation team and has worked closely with Frank Michelson to review the financial requirements that were incorporated into the RFP.
- **Frank Michelson – Chief Information Officer:** While somewhat short on patience, and often overly direct with colleagues and staff, Frank is nonetheless held in high esteem within the company. Managing an inventory of the size and scope of Technology Centers’ requires powerful and reliable data storage capabilities. His work first in developing these capabilities, and then in managing them has been an important factor in the company’s success. Frank has two primary concerns: First, any solution must include effective analysis tools. Second, through his work with Maria on the evaluation team, he believes that operating costs must be a vitally important consideration in any future solution.
- **Elaine Schnellling – Manager of Customer Service:** Prior to Elaine’s joining the company two and a half years ago, customer service received little attention. Coming from a consulting company that specialized in service organizations, Elaine transformed Technology Centers’ customer service offerings into a competitive advantage. While not a member of the evaluation team, Elaine believes strongly that her department has a vested interest in the new solution that is purchased. After all, the databases that support her customer contact system make up approximately 30% of the more than 30TB of data that currently reside on the legacy systems.
- **Yasmin Singh – Acquisition Manager:** Yasmin is a very new member of the Technology Centers team. He joined the company after holding a position as the Purchasing Manager for a high tech company. He is a member of the evaluation team and has two primary concerns. The first is to manage the evaluation and purchase process that has been defined for this project. His second concern is related to his ongoing responsibilities for managing Technology Centers’ vast inventory.
- **Herb Walker – Distribution Manager:** Herb has been with the company almost since it was formed. He began as a store manager where he developed a detailed knowledge of the company’s operations. Having seen his way through the struggles with the company’s initial implementation of IT systems, his is a highly influential voice in the decision-making process, though he is not a member of the evaluation team. Both from his past experiences, and through his current responsibilities Herb has developed an abiding concern for the availability of the company’s data systems.

EXERCISE – PART 1: CHALLENGES

Your instructor will assign one or more of the stages of the storage selling competency cycle for you to work on with your team. Review any information that is provided for the assigned stages and then develop answers to questions for the assigned stages. Be prepared to present the results of your team's work.

ESTABLISH RELATIONSHIPS

Questions

- Who would you want to speak with at Technology Centers as you prepare your proposal and your presentation?
- What questions would you prepare and rehearse for your initial meeting with these representatives of the company?

EDUCATE CUSTOMER AND ASSESS BUSINESS NEEDS

Questions:

- What information about Technology Centers' business operation would you want to find out?
- What would you want to educate the members of the evaluation committee about?

ASSESS TECHNICAL NEEDS:

You've learned that the project will require the migration of approximately 35 TB of data from the legacy storage devices.

Questions:

- What implications does this migration requirement have on your solution?
- What other technical information would you want to have?

DEMONSTRATE CAPABILITIES:

Technology Centers has peak seasons just as other retailers do.

Questions:

- What capabilities do you think will be important to demonstrate to the evaluation team?
- How might you use your understanding of Technology Centers' requirements during their peak seasons to your advantage?

OBTAIN COMMITMENT:

Questions:

- What would be the key points of any proposal you'd prepare for Technology Centers?

MAINTAIN RELATIONSHIPS:

Questions:

- If you were to develop an ongoing communications plan for Technology Centers, with whom would you try to stay in touch? Why?
- What are the key points you'd want to monitor after the solution is implemented? Why?

EXERCISE – PART 2: SOLUTIONS

Based on the information you have read, and the work you have done in Part 1 of this exercise, what components of a storage solution would you recommend to address the needs of Technology Centers?

RECOMMENDED SOLUTION COMPONENT(S)	COMMENTS

Additional opportunity worksheets and planning documents

Appendix C

Use the worksheets within this appendix to plan your own strategy for current and potential customer accounts.

<i>Customer Name:</i>	<i>Customer Industry:</i>
<i>Account Status:</i> <input type="checkbox"/> <i>Current HP StorageWorks customer</i> <input type="checkbox"/> <i>Current HP server customer</i> <input type="checkbox"/> <i>Competitive storage customer</i> <input type="checkbox"/> <i>Competitive server customer</i>	<i>HP StorageWorks Opportunity Timeframe:</i> <input type="checkbox"/> <i>Immediate</i> <input type="checkbox"/> <i>This month</i> <input type="checkbox"/> <i>This quarter</i> <input type="checkbox"/> <i>This year</i>
<i>Critical Business Challenges:</i>	<i>Critical Technical Challenges:</i>
<i>Storage Purchase/Lease Decision Makers: (Name & Title, Approval Level)</i> <input type="checkbox"/> <i>\$50K – \$100K</i> _____ <input type="checkbox"/> <i>\$100K – \$250K</i> _____ <input type="checkbox"/> <i>\$250 – \$500K</i> _____ <input type="checkbox"/> <i>\$500k – \$1M</i> _____ <input type="checkbox"/> <i>\$1M+</i> _____	<i>Competitive Challenges/Influences:</i>
<i>Storage Opportunities:</i> <input type="checkbox"/> <i>Explosive Data Growth</i> <input type="checkbox"/> <i>Storage and Server Consolidation</i> <input type="checkbox"/> <i>Multiple Operating System Support</i> <input type="checkbox"/> <i>Reduced Storage Management Complexity</i> <input type="checkbox"/> <i>High Availability</i> <input type="checkbox"/> <i>Improved Backup and Restore Efficiency</i> <input type="checkbox"/> <i>Business Continuation/Disaster Tolerance</i> <input type="checkbox"/> <i>SAN Optimization</i> <input type="checkbox"/> <i>Other:</i>	<i>CIO Issues:</i> <input type="checkbox"/> <i>Explosive Data Growth</i> <input type="checkbox"/> <i>Cutting/Stabilizing Costs</i> <input type="checkbox"/> <i>Aligning IT Investments with Business Directions</i> <input type="checkbox"/> <i>Building Strong IT Service Delivery</i> <input type="checkbox"/> <i>Selective Outsourcing</i> <input type="checkbox"/> <i>Resource Management</i> <input type="checkbox"/> <i>Security in All its Aspects</i> <input type="checkbox"/> <i>Enterprise Architecture</i> <input type="checkbox"/> <i>Systems Integration</i> <input type="checkbox"/> <i>Building Credibility for the Value of IT Services</i> <input type="checkbox"/> <i>Planning: Prioritizing IT Investments</i> <input type="checkbox"/> <i>Other:</i>
<i>Computing Environments (Quantity, Suppliers, Operating Systems):</i> <input type="checkbox"/> <i>Mainframes/OS</i> <input type="checkbox"/> <i>Servers/Application</i> <input type="checkbox"/> <i>Servers/Application</i> <input type="checkbox"/> <i>Desktops/Application</i>	

<i>Customer Name:</i>	<i>Customer Industry:</i>
<i>Key Storage Strategy Issues:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>DAS – Direct connect/server attached storage</i> <input type="checkbox"/> <i>NAS – Network Attached Storage</i> <input type="checkbox"/> <i>SAN – Storage Area Networks</i> <input type="checkbox"/> <i>Software Management</i> <input type="checkbox"/> <i>Backup</i> <input type="checkbox"/> <i>Archiving</i> <input type="checkbox"/> <i>Media Management</i> <input type="checkbox"/> <i>Storage services</i> <input type="checkbox"/> <i>Other storage strategy issues:</i> 	<i>Potential Enterprise Storage Solutions:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>HP StorageWorks XP</i> <input type="checkbox"/> <i>HP StorageWorks EVA</i> <input type="checkbox"/> <i>HP OpenView CASA</i> <input type="checkbox"/> <i>HP StorageWorks Virtual Array</i> <input type="checkbox"/> <i>HP StorageWorks NAS Solutions</i> <input type="checkbox"/> <i>HP StorageWorks Tape Libraries</i> <input type="checkbox"/> <i>HP Archival Systems</i> <input type="checkbox"/> <i>HP StorageWorks SAN Interconnects</i> <input type="checkbox"/> <i>HP OpenView SAM</i> <input type="checkbox"/> <i>HP OpenView Storage Data Protector</i> <input type="checkbox"/> <i>Third-Party Enterprise Backup Solution</i> <input type="checkbox"/> <i>HP OpenView Storage Media Operations</i> <input type="checkbox"/> <i>Leasing or Pay per Use</i> <input type="checkbox"/> <i>Enterprise Storage Services (see below)</i>
<i>Key Customer Value Propositions for Potential Enterprise Solutions and Services:</i>	<i>Potential Enterprise Storage Services:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>SAN Solution Service</i> <input type="checkbox"/> <i>ILM Solution</i> <input type="checkbox"/> <i>Backup and Recovery Solution Service</i> <input type="checkbox"/> <i>Data Migration Services</i> <input type="checkbox"/> <i>Data replication solution services</i> <input type="checkbox"/> <i>Disaster Tolerant Management Service</i> <input type="checkbox"/> <i>Storage virtualization solution services</i> <input type="checkbox"/> <i>Hardware/Software Implementation Service</i> <input type="checkbox"/> <i>HP Care Packs</i> <input type="checkbox"/> <i>SAN Environment Support</i> <input type="checkbox"/> <i>Critical Service for SAN</i> <input type="checkbox"/> <i>Business Continuity Services</i> <input type="checkbox"/> <i>Mission Critical Support for XP and EVA</i> <input type="checkbox"/> <i>Instant Support Enterprise Edition</i> <input type="checkbox"/> <i>Hardware Support</i>
<i>Action Steps:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>HP Adaptive Enterprise</i> <input type="checkbox"/> <i>ENSAextended Update</i> <input type="checkbox"/> <i>HP StorageWorks Update</i> <input type="checkbox"/> <i>HP OpenView SAM Update</i> <input type="checkbox"/> <i>Proposal</i> <input type="checkbox"/> <i>Business Value Model Report</i> <input type="checkbox"/> <i>Other</i> 	<i>StorageWorks Resources Required</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>Storage Sales Specialists</i> <input type="checkbox"/> <i>Storage Architect</i> <input type="checkbox"/> <i>Storage Systems Engineer</i> <input type="checkbox"/> <i>StorageWorks Competitive Team</i> <input type="checkbox"/> <i>Storage Call Center</i> <input type="checkbox"/> <i>Storage Events and Training</i> <input type="checkbox"/> <i>Storage Services Sales Specialist</i>

Account Planner

Instructions: Review the information you have compiled about your customer in the Opportunity Worksheet. Then think about what you know and compare it to what you believe you need to know in order to:

- Accurately assess your customer's needs
- The solutions you would propose to meet those needs
- Gain the commitment of decision makers and interested parties for your proposed solution
- Make the financial arguments necessary to justify the purchase of your proposed solution

Account Planner – Part 1

INFORMATION YOU NEED TO OBTAIN	
Technical	
DECISION MAKERS	
INFLUENCERS	
FINANCIAL	
COMPETITIVE	
BUSINESS CHALLENGES	
SUCCESS CRITERIA	
OTHER?	

Account Planner – Part 2

ACTION STEPS – HOW WILL YOU OBTAIN THIS INFORMATION?	
Technical	
Questions to ask:	Steps to take:
Decision makers	
Questions to ask:	Steps to take:
Influencers	
Questions to ask:	Steps to take:
Financial	
Questions to ask:	Steps to take:
Competitive	
Questions to ask:	Steps to take:
Business Challenges	
Questions to ask:	Steps to take:
Success criteria	
Questions to ask:	Steps to take:

Action Plan

Use the following form to list the top five actions you will take to further develop your relationship with your customer and to obtain their commitment to purchase HP storage solutions.

Action Plan

Action #1 – Top Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #2 – Top Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #3 – High Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #4 – High Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #5 – High Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	

<i>Customer Name:</i>	<i>Customer Industry:</i>
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INFLUENCERS	
FINANCIAL	
COMPETITIVE	
BUSINESS CHALLENGES	
SUCCESS CRITERIA	
OTHER?	

Account Planner – Part 2

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<i>Action Steps:</i> <ul style="list-style-type: none"> <input type="checkbox"/> <i>HP Adaptive Enterprise</i> <input type="checkbox"/> <i>ENSAextended Update</i> <input type="checkbox"/> <i>HP StorageWorks Update</i> <input type="checkbox"/> <i>HP OpenView SAM Update</i> <input type="checkbox"/> <i>Proposal</i> <input type="checkbox"/> <i>Business Value Model Report</i> <input type="checkbox"/> <i>Other</i> 	<table border="0"> <tr> <td><i>StorageWorks Resources Required</i></td><td><i>Date:</i></td></tr> <tr> <td><input type="checkbox"/> <i>Storage Sales Specialists</i></td><td>_____</td></tr> <tr> <td><input type="checkbox"/> <i>Storage Architect</i></td><td>_____</td></tr> <tr> <td><input type="checkbox"/> <i>Storage Systems Engineer</i></td><td>_____</td></tr> <tr> <td><input type="checkbox"/> <i>StorageWorks Competitive Team</i></td><td>_____</td></tr> <tr> <td><input type="checkbox"/> <i>Storage Call Center</i></td><td>_____</td></tr> <tr> <td><input type="checkbox"/> <i>Storage Events and Training</i></td><td>_____</td></tr> <tr> <td><input type="checkbox"/> <i>Storage Services Sales Specialist</i></td><td>_____</td></tr> </table>	<i>StorageWorks Resources Required</i>	<i>Date:</i>	<input type="checkbox"/> <i>Storage Sales Specialists</i>	_____	<input type="checkbox"/> <i>Storage Architect</i>	_____	<input type="checkbox"/> <i>Storage Systems Engineer</i>	_____	<input type="checkbox"/> <i>StorageWorks Competitive Team</i>	_____	<input type="checkbox"/> <i>Storage Call Center</i>	_____	<input type="checkbox"/> <i>Storage Events and Training</i>	_____	<input type="checkbox"/> <i>Storage Services Sales Specialist</i>	_____
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<input type="checkbox"/> <i>Storage Services Sales Specialist</i>	_____																

Account Planner

Instructions: Review the information you have compiled about your customer in the Opportunity Worksheet. Then think about what you know and compare it to what you believe you need to know in order to:

- Accurately assess your customer's needs
- The solutions you would propose to meet those needs
- Gain the commitment of decision makers and interested parties for your proposed solution
- Make the financial arguments necessary to justify the purchase of your proposed solution

Account Planner – Part 1

INFORMATION YOU NEED TO OBTAIN	
Technical	
DECISION MAKERS	
INFLUENCERS	
FINANCIAL	
COMPETITIVE	
BUSINESS CHALLENGES	
SUCCESS CRITERIA	
OTHER?	

Account Planner – Part 2

ACTION STEPS – HOW WILL YOU OBTAIN THIS INFORMATION?	
Technical	
Questions to ask:	Steps to take:
Decision makers	
Questions to ask:	Steps to take:
Influencers	
Questions to ask:	Steps to take:
Financial	
Questions to ask:	Steps to take:
Competitive	
Questions to ask:	Steps to take:
Business Challenges	
Questions to ask:	Steps to take:
Success criteria	
Questions to ask:	Steps to take:

Action Plan

Use the following form to list the top five actions you will take to further develop your relationship with your customer and to obtain their commitment to purchase HP storage solutions.

Action Plan

Action #1 – Top Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #2 – Top Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #3 – High Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #4 – High Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	
Action #5 – High Priority	
Action to take:	Desired result:
Anticipated contingencies or obstacles:	Plan(s) to address contingencies or obstacles:
DATE TO COMPLETE:	

Glossary of Storage Terms

Access

Read, write, or update information stored on a disk or other medium. (n) The operation of reading, writing, or updating stored information.

Access Time

The interval between the time a request is made by the system and the time the data is available from the drive. Includes the seek time, rotational latency, and command processing overhead time.

Advanced Data Guarding

RAID ADG offers fault protection of RAID volumes that are up to 2TB with a total of 56 disk drives in a RAID volume. RAID ADG requires the capacity of two drives for fault tolerance for any size of disk array. Available with some HP StorageWorks Smart Array Controllers.

AL_PA (Fibre Channel)

Arbitrated Loop Physical Address. A 1-byte value used in the Arbitrated Loop topology used to identify L_Ports. This value will then also become the last byte of the address identifier for each public L_Port on the loop.

Appliance

A low-cost device designed for a specific or limited purpose such as accessing the web or mail.

Arbitrated Loop (Fibre Channel)

One of the three Fibre Channel topologies. Up to 127 devices share the bandwidth of a single loop of fiber. Up to 126 NL_Ports and one FL_Port are configured in a unidirectional loop. Ports arbitrate for access to the loop based on their AL_PA. Ports with lower AL_PAs have higher priority than those with higher AL_PAs.

Archiving

Generally refers to long-term storage of important information on magnetic tape. DLT tape media is an excellent choice for archiving due to its 30-year shelf life.

Array

Two or more hard disks that read and write the same data. In a RAID system, the operating system treats the array as if it were a single hard drive.

Array Controller Software

Abbreviated ACS. Software contained on a removable ROM program card that provides the operating system for the array controller.

Asynchronous Replication

A method of deploying disaster-tolerant solutions. With asynchronous replication, data updates are locally implemented, locally stored, and at a later time, forwarded to all other remote copies. Replications can be executed in near real-time or after a predetermined interval, depending on the desired update window. Therefore, multiple data copies could become temporarily out of synch, until they are resynchronized into a consistent state.

ATM

Asynchronous Transfer Mode. A transport mechanism used in wide area networks.

ATM Gateways

ATM gateways (ATM/OC3 links for example) act as links between sites for long-distance asynchronous transmissions. See also **Optical Carrier Levels**.

Backplane

The electronic printed circuit board into which you plug subsystem devices—for example, the SBB or power supply.

Backup

A copy file, directory, or volume on a separate storage device from the original, for the purpose of retrieval in case the original is accidentally erased, damaged, or destroyed.

Backup Application

The specific software used to control the backup process (for example, ARCserve). Using this application, the system administrator can define which information to backup, where to send the backed-up information, the amount of file compression, and so on.

Backup Window

The time period within which backups are scheduled.

Bandwidth

The range of frequencies that can pass over a given circuit. Generally, the greater the bandwidth, the more information that can be sent through the circuit in a given amount of time. In data storage and data communications, bandwidth is usually expressed in terms of the amount of information sent over time, such as Mbps or Gbps. In analog communications, bandwidth is typically measured in Hertz (cycles per second).

Bit

Contraction of binary digit. A bit is the basic unit of information in the binary numbering system, representing either 0 (for off) or 1 (for on). Bits can be grouped to form larger storage units; the most common grouping is the 7- or 8-bit byte.

Bits per Second (BPS)

The number of binary digits, or bits, transmitted every second during a data-transfer procedure. Bits per second is a measurement of the speed of operation of equipment, such as a Compaq's data bus to a transmission line or network.

Block

A group of disk or tape records that is stored and transferred as a single unit such as a group of bits or characters. A block typically consists of 512 consecutive bytes of data stored on a storage device. In most storage systems, a block is the same size as a physical disk sector.

Bottleneck

A bottleneck is a point of data traffic congestion, often caused by software or a hardware device that retards or halts movement of data on a computer system or network.

Bridge

A device used to connect a SCSI device to a Fibre Channel network.

Bus Expander (Simple) (SCSI)

Devices that couple bus segments together without any impact on SCSI protocol or software/firmware are called simple bus expanders. The familiar DWZZX family are single-ended to differential bus expanders since they couple a differential bus segment to a single-ended bus segment. The term “expander” is a general term that includes both “extender” and “isolator” functions.

The DWZZC-DA functions both as an extender, since it extends the overall bus another 20 meters, and as an isolator, since it isolates bus segment 1 from bus segment 2. Note that the DWZZC-DA also functions as a differential to single-ended SCSI bus signal converter.

The Single-Ended DOC Personality Module (BA35X-FA) functions both as an isolator, since it isolates the BA356 internal SCSI bus segment 3 from SCSI bus segment 2, and as an extender, since it extends the overall bus 1 meter .

Bus Segment (SCSI)

A SCSI bus segment consists of all the conductors and connectors required to attain signal line continuity between every driver, receiver, and two terminators for each signal. It is not necessary that a SCSI bus segment contain any initiators or targets but it must have at least two devices attached. There are presently two types of SCSI bus segments offered by Compaq today:

- Single-Ended (SE)
- Differential (DF)

The bus segment type is determined by the properties of the terminators used. Devices that do not have the same transceiver type as the terminators cannot operate in the segment defined by the terminators.

Business-Critical Environments

Data that is required for the operation of a business that cannot be reconstructed without significant disruption of the business. See **Mission-Critical Environments**.

Business Value

The contribution that a single solution, or combination of solutions, adds directly to the achievement of business goals or objectives. Business value is commonly measured in terms of revenue growth and/or cost reduction.

Byte

Contraction of binary digit Eight. A group of 7 or 8 bits, also known as an octet. A byte usually holds a single character, such as a number, letter, or symbol. Because bytes represent a very small amount of storage, they are usually grouped into kilobyte (1,024 bytes), megabyte (1,048,576 bytes), gigabyte (1,073,741,824 bytes), and terabyte (1,099,511,627,776 bytes) groupings for convenience when describing capacity of size.

Cache

High-speed RAM used as a buffer between the CPU and a hard drive. Since the CPU can get information more quickly from the cache than main memory, the cache usually contains information that is used frequently by the system.

Capacity

The amount of information that can be stored on a given type of storage media. Also known as storage capacity.

Chunk

A unit of capacity, usually a couple of megabytes in size, and is the same as a **stripe** in **RAID striping**.

Cloning

A method of performing offline backup, a clone is a physical copy of a volume. The clone is created as a “third mirror” of the volume. Once the clone is made, it acts as a mirror until the clone is broken off. Typically, the application will be quiesced before the clone is broken off to ensure point-in-time data integrity. If the application is not quiesced, the clone will contain “crash consistent” data.

The clone operation can be applied to RAID 0, RAID 1 or RAID 0+1 volumes. See also **Snapshot** and **Snapcloning**.

Cold Swap

System must be powered down to swap component.

Compaq Insight Manager XE

Compaq Insight Manager XE is an intuitive systems management tool delivering fault, performance and configuration management for Compaq servers and desktop clients. The management software consists of the Insight Manager that runs on the management console and the operating system specific Insight Agent that runs on the server or managed desktop client.

Controller

A stand-alone device that typically connects between a host adapter and the storage devices. This device provides RAID functionality, typically has multiple buses/ports, and performs the lower layers of the interface protocol and normally operates in the initiator role.

Controller Failover

Dual-redundant controller configuration in which two controllers are connected to the same host and device buses. Use this configuration if you want to use two controllers to service the entire group of storagesets, single-disk units, and other storage devices. Because both controllers service the same storage units, either controller can continue to service all of the units if its companion controller fails.

Dark Fibre

1. 9-micron, single mode fiber optic cable that can be purchased from fiber-optic cable vendors or leased from communications companies.
2. Dark fibre consists of fibre-optic lines sold by a range of utilities companies, including electricity, highways, gas, railroad and water firms. It is termed *dark* fibre because it is unused and has no equipment to power it; when used and equipped, fibre is *lit*. Buying dark fibre significantly reduces network construction time with its associated regulatory, legal and technical complexities.

DAT

Digital Audio Tape. A family of small format (4 millimeter) helical scan tapes and tape drives, originally developed for recording audio.

Data Protection

Techniques used to ensure the integrity of data, including protecting data against media defects. RAID techniques provide different levels of data protection.

Data Striping

The process of segmenting logically sequential data, such as a single file, so that segments can be written to multiple physical devices (usually disk drives) in a round-robin fashion. This technique is useful if the processor is capable of reading or writing data faster than a single disk can supply or accept the data. While data is being transferred from the first disk, the second disk can locate the next segment.

DDS

Digital Data System. A family of 4 millimeter helical scan tapes and tape drives, based on DAT technology. DDS tapes have evolved to DDS-4. DAT tapes are less reliable and should not be used in DDS drives.

Density

The amount of data stored in a particular section of media. The higher the density, the more data stored in the same place.

Device

Devices include targets, initiators, and bus expanders. Current Fibre Channel protocol maps device addresses to look like SCSI IDs.

Differential SCSI Bus

A bus in which a signal's level is determined by the potential difference between two wires. A differential bus is more robust and less subject to electrical noise than is a single-ended bus.

Direct Access File System (DAFS)

A newly defined protocol for direct, memory-to-memory data transfer between devices and applications in data centre environments, designed for use with next generation interconnect technologies such as Virtual Interface and InfiniBand. DAFS promises to increase data transfer speeds between servers and storage devices over IP networks by over one-third.

Direct Attached Storage (DAS)

Dedicated storage connected to a server that enables access and resource allocation.

Direct Attach Storage (DAS) Islands

Disparate host and storage device pairs scattered throughout a company. DAS islands have no interconnection and do not allow for storage capacity sharing. For example, when one DAS island runs out of storage capacity, it cannot use another island's excess storage capacity.

Disaster Tolerance

A practice of duplicating operations at a primary site to another location permitting continuous or near-continuous operations. See **Data Replication Manager**.

Disk Array

A linked group of small, independent hard disk drives used to replace larger, single disk drive systems. The most common disk arrays implement RAID (Redundant Array of Independent Disks) technology.

Disk Compression

Using a utility to add disk space by making the files on a disk smaller. Some utilities (such as Windows DriveSpace) compress an entire disk automatically once it is used. This is called “run-time compression.”

DLT (Digital Linear Tape)

DLT is a high-speed tape format that uses streaming, serpentine recording instead of helical scan recording.

Dual-Redundant Configuration

A controller configuration consisting of two active controllers operating as a single controller. If one controller fails, the other controller assumes control of the failing controller’s devices.

Dynamic Allocation

Allows the sizes of data needs (arrays) to be changed while an operation is running.

ECB

External cache battery. The unit that supplies backup power to the cache module in the event the primary power source fails or is interrupted.

EMU

Environmental monitoring unit. A unit that provides increased protection against catastrophic failures. Some subsystem enclosures include an EMU which works with the controller to detect conditions such as failed power supplies, failed blowers, elevated temperatures, and external air sense faults.

Enterprise Network Storage Architecture

Compaq’s strategy of allocating storage resources online from a single, common pool, scaling from gigabytes to petabytes and beyond, as needed. Data can be replicated instantly for uses such as backup, report generation, and user-initiated backups and restores. Customers can manage distributed primary and backup storage resources centrally with new policy-based management practices, including dynamic allocation, automatic redeployment, intelligent data replication and protection, and performance tuning.

Enterprise Storage

Refers to a customer’s requirement to store, access and archive large amounts of data across all enterprise platforms.

Ethernet

Network protocol and cabling scheme with 10 megabits per second transfer rate.

ESCON (Enterprise Systems Connection)

Interconnect technology that connects IBM S/390 servers with each other, and with attached storage and other devices using optical fiber technology and dynamically modifiable switches called ESCON directors.

Fabric (Fibre Channel)

A crosspoint switched network, which is one of three Fibre Channel topologies. A fabric consist of one or more fabric elements, which are switches responsible for frame routing.

Fabric Switch

A device that enables the Fibre Channel fabric topology. A core building block of the SAN.

Fault Tolerance

A design method that ensures continued system operation in the event of individual failures by providing redundant elements.

FC-AL (Fibre Channel)

Fibre Channel Arbitrated Loop. A topology for connecting up to 127 ports in a loop. The bandwidth of the Arbitrated Loop is shared.

FC-BB (Fibre Channel)

Fibre Channel Backbone. A technology that allows switched fabrics to extend or ‘tunnel’ over WAN topologies using leased Telco lines. Speeds of 155Mb/s are available today, with 622Mb/sec and 1.244 Gb/s available soon. These speeds will allow for longer distance disaster tolerant solutions with high reliability and performance. The higher speeds allow for increased data bandwidth, and the increased distance is then secondary.

FC-IP (Fibre Channel-Internet Protocol)

FC-IP, also known as Fibre Channel tunneling or storage tunneling, is an Internet Protocol (IP)-based storage networking technology. FC-IP mechanisms enable the transmission of Fibre Channel protocol by tunneling data between SAN facilities over IP networks. This capability allows storage networking over a geographically distributed enterprise.

FL_Port (Fibre Channel)

A fabric port (in a switch or a router) where an N_ or an NL_ Port may attach.

Fiber Optic Cable

A transmission medium designed to transmit digital signals in the form of pulses of light. Fiber optic cable is noted for its properties of electrical isolation and resistance to electrostatic contamination.

Fibre

A generic Fibre Channel term used to describe all transmission media specified in the Fibre Channel Physical Layer standard (FC-PH), including optical fiber, copper twisted pair, and copper coaxial cable.

Fibre Channel

Logically, Fibre Channel is a bi-directional, full-duplex, point-to-point, serial data channel structured for high performance capability. Physically, Fibre Channel interconnects devices, such as host systems and servers, FC hubs and disks arrays, through ports, called N-Ports, in one of three topologies: point-to-point, an arbitrated loop, or a cross-point switched network (fabric).

File Compression

A technique that shrinks program or data files, so that they occupy less space. Some types of files, such as word processor documents, can be compressed by 50 percent or more.

Frame

A collection of bits that contain both control information and data; the basic unit of transmission on a network. Control information is carried in the frame with the data to provide for functions such as addressing, sequencing, flow control, and error control to the respective protocol levels. It can be fixed or variable length.

Frame Filtering

A filtering capability built into the ASIC silicon that enables new applications and features. It also provides the ability to “view” the first 64 bytes of a Fibre Channel frame. Frame filtering enables advanced capabilities such as LUN-level zoning and enhanced statistics gathering. Frame filtering can be used to filter out frames based on class of service, frame header and several bytes of optional header and/or data.

GBICs (Gigabit Interface Converters)

GBICs are the devices that are inserted into the ports of the Fibre Channel switch and hold the Fibre Channel cables. Currently, HP supports the following long-wave transceivers:

- 10 kilometer GBIC (1 Gbps)
- 100 kilometer GBIC (1 Gbps)
- 10 kilometer SFP (small-form factor pluggable- 2Gbps)
- 35 kilometer SFP (small-form factor pluggable - 2Gbps)

Gigabit Ethernet

A LAN transmission standard allowing data transfer at up to 1Gbps over optical fibre and used as an enterprise backbone. Used as the interconnect standard by NAS and reckoned by some to obviate the need for the added complexity of Fibre Channel and SANs.

Grid Computing

Formerly developed in the 1990s, a share computing approach that coordinates decentralized resources and uses open, general-purpose protocols and interfaces to high-quality service levels. A grid is designed to render almost any IT resource – computers, processing power, data Web services, storage space, software applications, data files or devices – as a grid service.

Heterogeneous SAN

A Heterogeneous SAN supports multiple host servers that run on more than one operating system and require homogeneous storage systems.

High Availability (HA)

A term applied to some disk arrays and clustered server configurations. High availability implies that the device can sense, report, and recover from some hardware failures. High availability components include redundant power supplies, fans, system processors (SPs), and RAID-enabled disk drives.

Homogeneous SAN

A Homogeneous SAN supports host servers that run on the same operating system, and require homogeneous storage systems.

Host

A processor using a disk array for data storage and retrieval.

Host bus adapter

HBAs link host servers or workstations to the storage area network - including storage subsystems and other Fibre Channel devices such as switches, hubs, tapes libraries and other servers - integrating the computing platforms, operating systems and input/output protocols to ensure interoperability and functionality.

Host Controller

A device that connects between a host system's I/O bus (for example, PCI) and the storage bus. This device provides RAID functionality, typically has multiple buses/ports, performs the lower layers of the interface protocol, and normally operates in the initiator role.

Hot-Pluggable Drives

Many Compaq servers are equipped with hot-pluggable drive cages which permit you to plug and unplug drives from the system while the system is running. This allows you to replace failed drives in RAID disk arrays without shutting down the server.

Hot Spare

Refers to a pre-installed spare component that is powered and ready to be configured online for automatic reconstruction in the event of a failure.

Hot Swap

A method of device replacement that allows normal I/O activity on a device's bus to remain active during device removal and insertion. The device being removed or inserted is the only device that cannot perform operations during this process. See also cold swap and warm swap.

Hub

A device used to connect several nodes in a network. A hub is a concentration point for data and repeats data from one node to all other connected nodes.

Independent Access Arrays

Arrays in which the member disks operate independently, even to the extent of satisfying multiple I/O requests concurrently. They provide a high disk I/O rate because each disk can be servicing a separate I/O request. The disk I/O rate will be approximately equal (within 5%) to the sum of the I/O rates of the member disks. The data transfer rate for a given block is the same as the transfer rate for a single disk because each block is stored on only one member disk. The total system transfer rate for an independent access array is similar to a parallel access array but may be split between several unrelated I/O requests. RAID levels 4 and 5 are independent access arrays. RAID levels 0 and 1 may be either parallel or independent but are usually implemented as independent arrays.

InfiniBand

Originally called System I/O, InfiniBand is an Internet protocol version 6 (IPv6)-based architecture and specifications for data flow between processors and I/O

devices. It offers up to 2.5Gbps data throughput and support for up to 64,000 addresses making device expansion almost limitless.

Initiator

A SCSI device that requests an I/O process to be performed by another SCSI device, namely, the SCSI target. The controller is the initiator on the device bus. The host is the initiator on the host bus.

Internet SCSI (iSCSI)

iSCSI is a new transport protocol for SCSI that operates on top of TCP. iSCSI advocates replacing the FC elements of a SAN with an IP-based network such as Gigabit Ethernet. Switched Ethernet and the possibility of TCP and IP processing in silicon may overcome the reliability, latency and server overhead disadvantages of Ethernet.

Inter-Switch Link (ISL) Protocol

A fabric switch protocol that provides a means for multiple switches to increase aggregate bandwidth throughput on the SAN.

IT Architecture

The blueprint or design for a computing system. Also referred to as the roadmap to link business and IT functions toward common business goals.

Architecture frameworks are commonly used in large enterprise systems to delineate the content and boundaries of an IT model. Typical components of an IT architecture framework are:

- Business
- Applications
- Information
- Technical
- Organizational

iFCP

iFCP is a protocol that translates communication from Fibre Channel devices, like server HBAs and storage systems, into an IP protocol compatible with a standard gigabit Ethernet network. Like FCIP, iFCP connects two SAN islands with a point-to-point tunnel across a metro- or wide-area-network. However, because iFCP converts Fibre Channel into a general purpose IP protocol, the SAN becomes part of the native IP fabric, able to connect many SAN islands instead of the point-to-point connection supported by FCIP.

IT Infrastructure

Physical components of computing system: the wiring, routers, switches, operating systems, middleware, mainframes, servers, storage devices, and sometimes desktop devices.

JBOD

Just a Bunch of Disks. A very simple and inexpensive storage technology used in storage-intensive applications such as imaging. JBOD is much simpler than RAID, since it refers to a rank of disks without data redundancy or striping. See also

RAID.

Latency

Refers to the delay in accessing data which comes from waiting for a disk to rotate to the specific location of the data on a track. Also known as rotational delay.

Library System

A system that uses a robotic mechanism to automatically load and unload tape cartridges into one or more tape drives.

Linear Tape-Open (LTO)

A new open standard for both high-speed and high-capacity tape back-up developed by IBM, Hewlett-Packard and Seagate. LTO comes in two different formats. Ultrium products are initially offering up to 100GB of native storage with Accelis reaching 25GB native, both at data rates up to 20MB/s.

Link (Fibre Channel)

The two fibers, copper or fiber optic, and their transmitters and receivers that form the bidirectional communication between the Fibre Channel ports.

LUN

Logical Unit (number). A unit is made up of one or more disk devices. A unit made up of more than one disk device is either a RAID-0, RAID-1, RAID0+1, or RAID-5 StorageSet, using StorageWorks software terminology.

LUN Zoning

Provides partitioning of a storage infrastructure to the individual LUN within a fabric, permitting transactions from a host to a specific set of LUNs on an array while disallowing access to (and visibility of) other LUNs in that array.

L_Port (Fibre Channel)

Loop port. Generic term for an NL_Port or FL_Port. For example, any Fibre Channel port that supports the Arbitrated Loop topology.

Megabyte

A unit of measurement equal to 1000 Kilobytes (KB) or 1,048,576 bytes.

Mirroring

Also known as RAID Level 1 or duplexing (when using two host bus adapters). Full redundancy is obtained by duplicating all data from a primary disk on to a secondary disk. The overhead of requiring 100% data duplication can be costly when using more than two drives.

Mission-Critical Environments

Environments where disruption to standard operating procedures may cause a significant impact. Impact is subject-specific and can range from the loss of life (NASA) to disruption of the quality of services (loss of airline reservations).

MTBF (Mean Time Between Failure)

Used to measure computer component average reliability / life expectancy.

Multiple Bus Failover

Controller or host initiated failover — with host assistance required. Dual-redundant controller configuration where each controller has its own connection (bus) to the host. If one host connection is lost, the host can access storage through the other connection.

Both controllers service the same storage units; in the event of a single controller failure, the second controller can continue to service all units. Both controllers communicate to each other through a backplane communication link.

Nearline Storage

Typically associated with Hierarchical Storage Management (HSM) where data is backed up to tape or optical devices and can be made available as needed through the use of automatic tape libraries. Frequently allows end-user initiated restores.

Network Attached Storage (NAS)

A dedicated server-storage system attached to a local area network that can provide shared storage between heterogeneous clients.

NL_Port (Fibre Channel)

Node-Loop port. An N_Port that can operate on the Arbitrated Loop topology.

N_Port (Fibre Channel)

Node port. A port on a computer, disk drive, and so on, through which the device does its Fibre Channel communication.

Offline Storage

Data which has been archived and stored. Typically requires manual intervention to access. See **Nearline Storage**.

Online Storage

Active and inactive data which is immediately available to end-users without assistance. Considered “live”.

Open SAN

An Open SAN supports heterogeneous server platforms as well as heterogeneous storage systems.

Optical Fiber

Optical fiber (or fiber optic) refers to the medium and the technology associated with the transmission of information as light pulses along a glass or plastic wire or fiber. Optical fiber carries much more information than conventional copper wire and is in general not subject to electromagnetic interference and the need to retransmit signals. Most telephone company long-distance lines are now of optical fiber.

Optical Carrier Levels (OC-x)

ATM/OC3 links are used to connect Fibre Channel lines at each end of the network. The base rate (OC-1) is 51.84 Mbps. OC-2 runs at twice the base rate, OC-3 (155.52 Mbps) at three times the base rate, and so forth. See also **ATM Gateways**.

Parallel Interface (SCSI)

SCSI is a parallel interface. Eight or sixteen bits are transmitted in parallel over multiple copper fibers. Transmission is fast, but distances typically become shorter as speed is increased because of signal recovery and quality problems.

Parity

A form of data redundancy used by RAID levels 2, 3, 4, and 5 to recreate the data of a failed drive in a disk array.

PCI-X

A compatible extension of the existing PCI Bus, the 64-bit PCI-X architecture runs at speeds up to 133 MHz, providing burst transfer rates above 1 gigabyte per second. This critical I/O bandwidth is needed for industry standard servers running enterprise applications such as Gigabit Ethernet, Fibre Channel, Ultra3 SCSI and Cluster Interconnects. PCI-X ensures investment protection because it offers backward compatibility with existing PCI based systems and a stable and complementary technology roadmap for future I/O standard system architectures.

Performance

A measure of the speed of the drive during normal operation. Factors affecting performance are seek time, transfer rate, and command overhead.

Petabyte

A unit of measurement for physical data storage equal to two raised to the 50th power, i.e., 1,125,899,906,842,600 bytes.

Port

A hardware entity that connects a device to a Fibre Channel topology. A device can contain one or more ports.

Private Loop (Fibre Channel)

An Arbitrated Loop that stands on its own and is not connected to a fabric.

Protocol

A formal set of rules governing the format, timing, sequencing, and error control of exchanged messages on a data network. A protocol may be oriented toward data transfer over an interface, between two logical units directly connected, or on an end-to-end basis between two end users over a large and complex network.

Public Loop (Fibre Channel)

An Arbitrated Loop that is connected to a Fabric.

QuickLoop

Enables Fibre Channel private-loop devices in legacy environments to migrate to a fully scalable fabric in a SAN.

RAID (Redundant Array of Independent Disks)

A method of configuring multiple disks into a logical disk unit, which appears to the host as a single, contiguous disk module.

RAID Level 0

A RAID storage set that stripes data across an array of disk drives. A single logical disk spans multiple physical disks, allowing parallel data processing for increased I/O performance. While the performance characteristics of RAID level 0 is excellent, this RAID level is the only one that does not provide redundancy. RAID level 0 storage sets are sometimes referred to as stripesets.

RAID Level 1+0

A RAID storage set that stripes data across an array of disks (RAID level 0) and mirrors the striped data (RAID level 1) to provide high I/O performance and high availability. This RAID level is alternatively called a striped mirrorset. RAID level 0+1 storage sets are sometimes referred to as striped mirrorsets.

RAID Level 1

A RAID storage set of two or more physical disks that maintains a complete and independent copy of the entire virtual disk's data. This type of storage set has the advantage of being highly reliable and extremely tolerant of device failure. RAID level 1 storage sets are sometimes referred to as mirror sets.

RAID Level 3

A RAID storage set that transfers data parallel across the array's disk drives one byte at a time, causing individual blocks of data to be spread over several disks serving as one enormous virtual disk. A separate redundant check disk for the entire array stores parity on a dedicated disk drive within the storage set. See also **RAID level 5**.

RAID Level 5

A RAID storage set that, unlike RAID level 3, stores the parity information across all of the disk drives within the storage set. See also **RAID level 3**.

RAID Level 3/5

A DIGITAL-developed RAID storage set that stripes data and parity across three or more members in a disk array. A RAID set combines the best characteristics of RAID level 3 and RAID level 5. A RAID set is the best choice for most applications with small to medium I/O requests, unless the application is write-intensive. A RAID set is sometimes called parity RAID. RAID level 3/5 storage sets are sometimes referred to as RAID sets.

RAID set

See **RAID level 3/5**.

Read

To glean information from a storage device, like a floppy disk.

Recovery point objective (RPO)

The point to which data must be restored, or the amount of data loss acceptable.

Recover time objective (RTO)

The time by which data must be restored, or the amount of time it takes to come back online.

Redundant

A duplicate disk or component that provides a recovery path in case of a failure.

Redundancy

Having one or more backup systems available in case of failure of the main system.

Reliability

The probability that an item can perform its intended function for a specified interval under stated conditions. Also the probability that parts, components, products, or systems will perform their designed-for functions without failure in specified environments for desired periods at a given confidence level.

Remote Copy Set (RCS)

A set of two or more LUNs that contain the same data, with one LUN on an Initiator, and the others on the Targets. ACS V8.5P allows twelve remote copy sets per controller pair. Windows NT limitations allow only 7 remote copy sets (SWCC

and DTSM need one LUN to communicate with the HSG80 controller). Future versions of ACS will support an increased number of remote copy sets.

Remote Replication

The ability to manage, launch and administer data replication.

SAN (Storage Area Network)

See **Storage Area Network**.

Scaleable

Refers to technology applications which can be made greater or smaller without huge leaps in cost.

SCSI (Small Computer Systems Interface)

A PC bus interface standard that defines standard physical and electrical connections for devices. This standard enables many different kinds of devices, such as disk drives, magneto optical disks, CD-ROM drives, and tape drives to interface with the host computer.

SCSI Domain (SCSI)

A SCSI domain is a logical bus with at least one bus segment, at least one initiator, and at least one target. Domains with multiple bus segments are enabled through the use of bus expanders. Domains are limited by device addressability. Domains are limited to a maximum of 16 initiators and/or targets without the use of LUN bridges.

SCSI Extender (SCSI)

An integrated circuit that allows for greater connectivity in separate enclosures, giving more freedom to customers for expansion of storage subsystems from 42 devices to 72. This circuit allows for extension of single-ended and differential SCSI in Ultra SCSI and non-Ultra SCSI environments.

SDLT (Super Digital Linear Tape)

A later version of DLT tape drive technology which is a high-speed tape format that uses streaming, serpentine recording instead of helical scan recording.

Seek Time

The time it takes the drive's read/write head to locate the track that stores the particular piece of data (in milliseconds).

Serial ATA

Serial ATA is an evolutionary replacement for the Parallel ATA physical storage interface. Serial ATA is scalable and will allow future enhancements to the computing platform.

Serial Interface (Fibre Channel)

Fibre Channel is a serial interface. Bits are transmitted one bit at a time on a single fiber. Link distances limits at Gigabit speeds are specified as 24 meters on copper, 300 meters on multimode fiber, and 10 kilometers on single mode fiber.

Serial Storage Architecture (SSA)

Storage interconnect technology that is a high-speed serial interface that was developed and promoted by IBM.

Server

A powerful computer system with a large hard disk capacity that serves the information access and communication needs of multiple users. Often servers are dedicated to a particular function such as Internet access, printing, file management, backup, and network communications.

Shadowing

Mirroring as done by the RAID Array is hardware mirroring whereby you end up with two disk drives that look exactly the same. Shadowing is software shadowing so rather than having the mirroring be done by the hardware, the mirror or shadow is created by the software.

Snapclone

See **Virtually Instantaneous Snapclone**.

Snapshot

A method of performing offline backup, a snapshot is a virtual copy of a volume. The snapshot is created instantly. Like a clone, the application should be quiesced before the snapshot is taken to ensure data integrity.

The snapshot operation can be applied to RAID 0, RAID 1, RAID 0+1 or RAID 3/5 volumes. See **also Cloning** and **Virtually Capacity-Free Snapshot**.

SnapReplica

Result of StorageWorks Snap. The SnapReplica is a “new” virtual disk that can be used for many purposes, including Restore and offline application testing.

Provides an automatic means to instantaneously protect data against human and application errors. SnapReplicas can be designated for use in application testing and other ongoing purposes.

SnapRestore

Process by which applications quickly and easily restore data from a SnapReplica. Allows almost instantaneous restore of extremely large volumes.

SNMP

Since it was developed in 1988, the Simple Network Management Protocol has become the de facto standard for internetwork management. Because it is a simple solution, requiring little code to implement, vendors can easily build SNMP agents to their products. SNMP is extensible, allowing vendors to easily add network management functions to their existing products. SNMP also separates the management architecture from the architecture of the hardware devices, which broadens the base of multivendor support.

Solution

A combination of products and services that solves specific customer challenges, or responds to specific customer requests.

Spin Rate

The number of revolutions of the disk per minute.

Storage Area Network (SAN)

A Storage Area Network (SAN) is a network that connects storage devices, such as disk, tape, and CD ROM drives to all types of computing devices. It is based on the Fibre Channel interconnect. The SAN provides high-speed, fault-tolerant

access to data for the various client, server, and host computers. These computing devices can be as simple as a small workstation or a large mainframe system. See also **Heterogeneous SAN**, **Homogeneous SAN** and **Open SAN**.

Storage Capacity

Capacity	Number of Bytes*	In Decimal, About...
Petabyte	2 to the 50 th power	1000 terabytes
Terabyte	2 to the 40 th power	1000 gigabytes
Gigabyte	2 to the 30 th power	1000 megabytes
Megabyte	2 to the 20 th power	10,000 kilobytes or 1,000,000 bytes

* One byte is 8 bits long.

Storage Pool

A storage concept that allows storage capacity in a virtual environment to be managed as a common resource to be shared among all users and under central or distributed control as required.

Storage Virtualization

Storage virtualisation describes efforts to abstract the discrete characteristics of physical storage devices into virtual objects with the intention of making storage systems more flexible and manageable. Virtual disks can be used by applications in the same way as their physical equivalents, while allowing administrators to reassign resources without making hardware modifications or disrupting the applications.

StorageSet

A set of disk devices, typically spread across the 6 SCSI buses behind a StorageWorks Array that conforms to RAID-0, RAID-1, RAID0+1, or RAID-5 format. RAID0 is not recommended for RCS members as it reduced the fault tolerance of the solution.

Stripe

A unit of capacity, usually a couple of megabytes in size, and is sometimes referred to as a **chunk**.

Striping

Spreading data evenly over multiple disk drives to enhance performance. Data striping can be performed on a bit, byte, or block basis for optimum application performance.

Switch (Fibre Channel)

A fabric switch. A Fibre Channel connection device that provides multiple, simultaneous full-bandwidth connections between devices.

Synchronous Data Replication

A method of deploying disaster-tolerant solutions. synchronous data replication ensures that data copies are always identical to prevent critical data loss in the event of a failure or disaster. In this mode, data is written simultaneously to the cache of the local subsystem and the remote subsystems, in real time, before the application I/O is completed, thereby ensuring the highest possible data consistency.

System I/O Bus

Storage interconnect technology in which storage is directly attached to servers.

T-1

A wide area network leased line service connection, running at a speed of up to 1.544 Mbps.

T-3

A wide area network leased line service connection, running at a speed of up to 45 Mbps.

Tape Library

A device containing one or more tape drives and a varying number of tapes. Tape libraries are an essential component of backup and restore operations in large SANs.

Target

A device that performs an operation requested by an initiator.

Terabyte

A unit of measurement equal to 1000 gigabytes (GB) or 1,099,511,627,776 bytes.

Terminator (SCSI)

Terminators are interconnect components that form the ends of the transmission lines in bus segments. A SCSI domain must have at least one segment and therefore at least two terminators. Terminators are used to pull inactive SCSI bus signals to a known state. There are two basic types of terminators — active and passive.

1. Active linear terminators are required for single-ended segments.
2. Passive or Linear totem pole terminators are required for differential segments.

Topology

The logical and/or physical arrangement of devices viewed on a network.

Transfer Rate

The speed at which data can be transferred.

Transparent Failover

See **Controller Failover**.

Trunking

Port **trunking** allows the aggregation of multiple ports into a single group, effectively combining the bandwidth into a single connection. Port trunking also allows the creation of multi-gigabit pipes to transport traffic through the highest traffic areas of a network.

Ultra SCSI Bus

A wide, Fast-20 SCSI bus.

Ultrium

A Linear Tape-Open (LTO) tape format.

UPS

Uninterruptible power supply. A battery-powered power supply guaranteed to provide power to an electrical device in the event of an unexpected interruption to the primary power supply. Uninterruptible power supplies are usually rated by the amount of voltage supplied and the length of time the voltage is supplied.

VersaStor Technology

VersaStor Technology by Compaq is the *StorageWorks* hardware and *SANworks* software implementation that enables storage **virtualization** to take place at the server, the SAN fabric and storage system levels.

VHDCI Connector (SCSI)

The Ultra SCSI interconnect is based on the VHDCI external wide SCSI connector and is being used on all new SCSI external ports. The new interconnect is about one-third the size of current wide SCSI connectors and eliminates the need for right-angle cables. This smaller, more flexible cable enables up to four wide SCSI ports/PCI slots and two ports per StorageWorks shelf.

Virtual Disks

A disk defined as a logical entity that has one or more physical disks providing the actual storage capacity.

Virtualization

See **Storage Virtualization**.

Virtually Capacity-Free Snapshot

In a Virtually Capacity-Free Snapshot, the storage system does *not* reserve capacity for the snapshot volume in advance. Rather, space in the snapshot volume is used only as the original virtual disk's data is changed. The snapshot volume is a new virtual disk that initially shares the original virtual disk's map entries. As the original virtual disk is written, free space is consumed as necessary to preserve the original contents of the snapshot.

Virtually Instantaneous Snapclone

A method of performing backup, a virtually instantaneous snapclone makes a complete copy of the original virtual disk as quickly as data transfer rates permit, resulting in two identical independent copies of the data in the shortest time possible.

There is an important difference between virtually instantaneous snapcloning and traditional **cloning**. With traditional controllers, the clone copy is not available until the copy is complete. With virtually instantaneous snapclones, the snapclone data can be accessed virtually immediately. As the virtually instantaneous snapclone is being created, the controller is able to access the original virtual disk for the data and keep track of what data has changed since the instant the virtually instantaneous snapclone was taken. The benefit of a virtually instantaneous snapclone is that users get a point-in-time clone of a virtual disk essentially immediately.

Vraid (Virtual Redundant Array of Independent Disks)

With **VersaStor**, all Vraid sets are distributed across the disks assigned to the disk pool. Since all the spindles in the pool should, on average, carry the same workload, the load is automatically balanced across spindles, resulting in better performance. In conventional RAID, a set of disks can only have a single RAID level, so multiple RAID levels must reside on discrete groups of disks.

Wake-on-LAN (WOL)

Often, IT personnel prefer to maintain client systems after employees have gone home. Even if these tasks are automated, client machines must be left on. In the

past, if they weren't left on, personnel had to manually turn them on. But, with wake-on-LAN, client systems can be remotely and automatically powered up.

Wake-on-LAN technology resides in a PC's managed network adapter and motherboard. The two are attached via a wake-on-LAN cable terminated by a 3-pin connector on each side.

When the system is turned off, the managed network adapter uses an alternate power source to monitor the network and watch for a wake-up packet from the server. Once it receives a packet, it alerts the system to power up and accept any maintenance task it is given. Wake-on-LAN is a part of Intel's Wired for Management System.

Wake-on-LAN is also called remote wake-up.

Warm Swap

A device replacement method that allows the complete system to remain online during device removal or insertion. The system bus may be halted, or quiesced, for a brief period of time during the warm-swap procedure.

World Wide Name

A 64-bit unique identifier assigned to a device. See also **Zoning**.

Write

To put information onto a storage device, like a floppy disk.

Write-Back Caching

A cache management method used to decrease the subsystem's response time to write requests by allowing the controller to declare the write operation "complete" as soon as the data reaches its cache memory. The controller performs the slower operation of writing the data to the disk drives at a later time.

Write-Through Caching

A cache management method used to decrease the subsystem's response time to a read. This method allows the controller to satisfy the request from the cache memory rather than from the disk drives.

Zoning

Limiting access by servers to LUNs, based on a device's World Wide Name.

Answers to test pool for Selling HP Enterprise Storage Solutions

Learning checks

Module 1 — Enterprise SAN Market opportunities

1. Which of the following is **not** a current trend in the storage market?
 - a. Brand recognition will be a critical factor in the selection of storage vendors.
 - b. The overall trend in storage is toward direct attached storage solutions.
 - c. A key challenge for IT departments will continue to be “to do more with less.”
 - d. There is skepticism in investing in new technologies and, therefore, a conservative approach to investing in new solutions.

2. Based on the information in this module, which of the following companies holds the number two position in the disk storage systems market?
 - a. DELL
 - b. EMC
 - c. IBM
 - d. HP

3. Based on the information in this module, which of the following is **not** an industry in which you would look for customers who have the requirement for high availability?
 - a. Publishing
 - b. Finance
 - c. E-commerce
 - d. Telecommunications

Module 2 — Enterprise storage business value sales model

1. Business value creates additional profits for customers by influencing which of the following?
 - a. Automation of business processes
 - b. Productivity of office workers
 - c. Growth of revenues and reduction of expenses
 - d. Internal business focus

2. Value selling is the process of helping customers connect IT to their _____ and measuring the improvement in business value as they change IT strategies.
 - a. Business
 - b. Accounting systems
 - c. IT staff
 - d. Networks

3. What do salespeople need to change in their approach in order to be perceived as value sellers versus traditional sellers?
 - a. Relationship building, better customer knowledge, linking IT to the customer business, communication in terms that senior managers understand
 - b. Learning with the customer, collaborating long-term, and building transactional relationships
 - c. Understanding the customer's business, key objectives, critical success factors, and key metrics
 - d. Communicating in terms senior managers understand, i.e., business terms.

4. *Application value, number of users and availability* are characteristics of which of the following contributors within the business value methodology?
 - a. Business flexibility
 - b. Service levels
 - c. Operational efficiencies
 - d. Rate of application change

5. Which **two** of the following statements are **true** concerning the HP Business Value Model software?
 - a. The software was developed by HP.
 - b. The software uses a tested methodology combining cost, technology, and business modeling.
 - c. The software predicts how changes in storage architectures will impact business results.
 - d. The software is based on hypothetical lab data.

Module 4 — Enterprise vision, mission, and strategy

1. Which of the following best summarizes the HP corporate value proposition?
 - a. HP customers get more.
 - b. HP demands more.
 - c. HP delivers more.
 - d. HP customers enjoy more.

2. Which three statements describe an Adaptive Enterprise environment? (Select THREE.)
 - a. A common foundation that can run any application and business process
 - b. An infrastructure driven by business strategy and business processes
 - c. An environment where IT supply meets business demand
 - d. A full suite of IT strategy, architecture, planning, and business case development services

3. Which three of the following refer to the ENSAextended strategy?
 - a. It is the HP strategy for delivering HP Adaptive Enterprise storage requirements.
 - b. It should be de-emphasized with customers.
 - c. It is the method used to provide managed storage resources for the Darwin architecture.
 - d. It is an architecture in which the Darwin architecture is a subset.

4. Which of three of the following characteristics describe the HP storage vision?
 - a. Storage management tightly coupled to physical resources, with a view of all the physical details
 - b. Application-aware so that resources are automatically provisioned to meet application needs
 - c. Scalable in terms of capacity, performance, availability, and other dimensions
 - d. A unified storage ecosystem that can be partitioned to meet business needs

5. Select the correct phrase to complete this sentence: HP's definition of Information Life Cycle Management is the active management of information from creation to deletion, according to _____, with automation to enforce application-specific policies, and that aligns with business and application needs.
- a. specific industry rules and regulations
 - b. its changing business relevance over time
 - c. best practices
 - d. the Darwin Reference Architecture
6. Which of the following is **not** a benefit of HP's StorageWorks Reference Information Storage System (RISS)?
- a. Reduced storage management complexity via virtualization
 - b. Compliance with data retention regulations
 - c. Helps manage storage costs
 - d. Full content indexing and grid computing for rapid search and retrieval and scalability

Module 5 — Network storage solutions product portfolio

1. The HP NSS family name for platform software such as Business Copy is which of the following?
 - a. HP StorageWorks
 - b. HP OpenView
 - c. HP enterprise network storage architecture
 - d. HP ProLiant

2. Write the letter below indicating the HP branding convention next to the corresponding description.

A. HP StorageWorks	B. HP OpenView
<u>A</u> Family name for most hardware solutions	
<u>B</u> Family name for storage management software	

3. Which of the following is array systems provide continuous access support?
 - a. HP StorageWorks Virtual Array 7110
 - b. HP StorageWorks Virtual Array 7410
 - c. HP StorageWorks Enterprise Virtual Array 5000
 - d. HP StorageWorks Modular SAN Array 1000

4. The HP StorageWorks MSL6000 tape library is positioned for which customer market?
 - a. Entry-level
 - b. Mid-range
 - c. Enterprise

5. HP OpenView Storage Media Operations is positioned within which of the following software categories?
- a. Storage area management
 - b. Data protection and management
 - c. High availability / disaster recovery
 - d. Virtualization

Module 6 — Storage virtualization

1. In virtualization, storage resources are assembled into a _____, and a _____ is created from the pool and presented to the servers.
 - a. Storage pool, mapping function
 - b. Storage pool, virtual disk
 - c. LUN, virtual disk
 - d. Physical disk, JBOD

2. A _____ occurs when a server I/O is initiated that translates the host view of the disk into physical data.
 - a. Virtual disk
 - b. LUN
 - c. Mapping function
 - d. Server

3. Which target customer is **not** appropriate for virtualization?
 - a. Storage networks with low storage utilization rates
 - b. Networks where administrators spend too much time on disk management
 - c. Heterogeneous environments requiring data replication
 - d. Applications with highly predictable storage demands

4. The HP host-based virtualization product that enables storage consolidation and simplifies management is:
 - a. Enterprise Virtual Array (EVA)
 - b. HP OpenView Storage Virtual Replicator
 - c. CASA
 - d. Virtual RAID

5. Which of the following is **not** a benefit of HP storage virtualization?
- a. Increased utilization
 - b. Reduced application downtime
 - c. Continuous access
 - d. Mirroring across heterogeneous devices

Module 7 — HP StorageWorks XP

1. XP customers almost always have which of the following?
 - a. Extremely high volumes of data (10–20TB)
 - b. Need for extreme availability
 - c. Extremely high volumes of data (10-20TB) and need for extreme availability
 - d. Non-mission critical environments
2. The HP StorageWorks XP128 provides up to how much capacity?
 - a. 12TB
 - b. 18TB
 - c. 36TB
 - d. 72TB
3. The HP StorageWorks XP1024 and XP128 disk arrays support which of the following?
 - a. Mainframe operating systems only
 - b. Open system operating systems only
 - c. Fewer operating systems than the HP StorageWorks EVA
 - d. Both mainframe and open system operating systems
4. Business Copy XP is a _____.
 - a. Powerful management application that brings monitoring and tuning of the disk array XP system resources to a single desktop.
 - b. Local mirroring product that maintains one or several copies of critical data.
 - c. High-availability data and disaster recovery solution that enables real-time data mirroring between local and remote XP disk arrays.
 - d. A means of data sharing between different applications and systems.

5. Command View XP contributes to which of the following customer business needs?
 - a. Business continuity
 - b. Data protection
 - c. More efficient management
 - d. Disaster recovery

6. Customers who have a need for sharing data between mainframes and open system servers on a single XP disk array would benefit by which of the following?
 - a. Auto Path XP
 - b. Data Exchange XP
 - c. Business Copy XP
 - d. Application Policy Manager XP

7. A key differentiator between frame-based and monolithic arrays is that with a frame-based array a customer can do which of the following?
 - a. Support a maximum of two operating systems
 - b. Add array controllers and disk cabinets over time to increase storage capacity and performance
 - c. Support only mainframe systems
 - d. Convert to a monolithic solution

8. Characteristics of Pay per Use for XP target customers include which of the following? (Select THREE.)
 - a. Seasonal variation in storage usage
 - b. Concern for risk of failing to satisfy Service Level Agreements
 - c. Need protection against disasters
 - d. Would rather purchase than lease
 - e. Balances risks and costs associated with storage investment

9. The HP StorageWorks XP differs from the HP StorageWorks EVA5000 in that the XP _____. (Select THREE.)
- a. Offers heterogeneous operating system support
 - b. Provides disaster recovery solutions
 - c. Is based on a traditional storage architecture
 - d. Offers the highest levels of mission-critical support
 - e. Is a frame-based architecture
10. In an HP StorageWorks XP multi-site disaster tolerant solution, HP provides which of the following?
- a. Provides mirrored arrays in three regional sites within 30 km of each other
 - b. Provides two data centers less than 100 km apart
 - c. Provides mirrored arrays in two data centers close to user sites and a third array in an out-of-region data center
 - d. Provides two data centers less than 200 km apart

Module 8 — HP StorageWorks enterprise virtual array

1. Which set of characteristics best describes the EVA target customer?
 - a. Needs simplified storage management; has storage requirements of less than 1TB; needs to offload storage traffic from the enterprise network
 - b. Looking to save operational costs; experiencing an increasing demand on storage resources; has a low IT budget
 - c. Has storage capacity requirements of greater than 1TB; has large IT budget but is looking for more effective use of storage resources; wants simplified storage management; is concerned about high availability
 - d. Wants to lower total cost of ownership; needs more efficient storage utilization; looking for a low cost solution
2. Vsnap contribute to operational cost-savings and efficiencies by:
 - a. Enabling the user to easily add disk space as needed
 - b. Not requiring the storage system to reserve capacity for the snapshot volume in advance
 - c. Providing a simplified management interface
 - d. Providing five levels of user data protection
3. Which statement comparing Data Replication Manager (DRM) and Continuous Access (CA) is **true**?
 - a. Both offer asynchronous and synchronous modes
 - b. DRM offers a command line interface while CA offers a central GUI
 - c. DRM offers 256 host connections while CA offers 320 host connections
 - d. Both offer space-efficient Vsnap capability
4. With 146GB disks, two controllers, two 2C12D cabinets, and the optional expansion cabinet, capacity of the EVA expands to a maximum of _____ TB.
 - a. 12
 - b. 24
 - c. 70
 - d. 168

5. Continuous Access for EVA contributes to which of the following **two** customer business needs?
 - a. Business continuity
 - b. Reduces impact on application processing
 - c. Faster backup
 - d. Disaster recovery

6. The EVA3000 is suitable for customers who expect storage capacity to increase to ____ TBs over a 2 to 3 year period.
 - a. 4 TB
 - b. 8 TB
 - c. 20 TB
 - d. 35 TB

7. Pay Per Use for StorageWorks EVA is appropriate for customers who (Select THREE):
 - a. Want to match costs with charge back usage to their customers
 - b. Have stable IT cost structures
 - c. Have daily, monthly or seasonal variations in utilization
 - d. Prefer to lock capital into storage infrastructure
 - e. Risk high impact of not satisfying Service Level Agreements

Module 9 — HP OpenView Continuous Access storage appliance

1. Which of the following best describes the CASA appliance?
 - a. Mid-range storage array
 - b. Network gateway
 - c. Storage replication device
 - d. Storage interface to IBM mainframes

2. Which storage vendor is not supported by CASA?
 - a. HP-UX
 - b. EMC Symmetrix
 - c. Silicon Graphics Infinite Storage
 - d. Microsoft Windows

3. The CASA is positioned for ongoing support of which operating environments?
 - a. Windows, HP-UX and IBM AIX
 - b. HP-UX and IBM AIX
 - c. Windows and HP-UX
 - d. Windows, HP-UX, IBM AIX and Solaris

4. HP positions CASA to be sold when _____ (Select TWO):
 - a. A midrange configuration needs cost-effective data replication
 - b. The customer is utilizing HP and/or EMC storage arrays
 - c. Configuring mission-critical configurations
 - d. Single host/host cluster configurations
 - e. Configuring primarily for data migration

Module 10 — HP StorageWorks virtual array

1. A customer who has a business need to eliminate points of failure between servers and the storage subsystems would be interested to learn about the VA7410s _____.
 - a. Storage consolidation features
 - b. Ability to support both HP and heterogeneous environments
 - c. Ability to support environments whose data storage requirements are growing rapidly.
 - d. Ability to support environments that require high availability access to information.
2. The VA7410 can support up to ____ disks.
 - a. 24
 - b. 75
 - c. 105
 - d. 125
3. Which of the following is **not** a customer benefit of an entry-level SAN solution?
 - a. Makes it possible to create strategies to simplify storage deployment and management
 - b. Protects critical applications in a JBOD environment
 - c. Lowers the total cost of ownership
 - d. Minimizes requirements for staff resources
4. HP StorageWorks Auto Path Virtual Array contributes to which of the following customer business needs?
 - a. Disaster recovery
 - b. Data protection
 - c. I/O multi-path failover
 - d. Virtualization

5. Match the feature of the VA7410 with the business need that it addresses.

- a. Heterogeneous support
- b. Server and storage consolidation
- c. High availability
- d. Rapid data base growth and recovery

___ **b** ___ Customers can combine storage disks of different sizes within a single enclosure.

___ **c** ___ Integration with upper-level enterprise management tools like HP OpenView Storage Secure Path allow for maximum uptime.

___ **a** ___ Support for industry-leading operating system platforms include Microsoft Windows NT, Windows 2000 (Advanced Server), Sun Solaris, HP-UX, IBM-AIX, Linux, NetWare, and MPE/iX.

___ **d** ___ The ability to quickly add storage capacity.

Module 11 — HP StorageWorks NAS solutions

1. Which of the following storage features has **not** been described in this module as a NAS feature?
 - a. Optimized file serving
 - b. NAS/SAN fusion
 - c. Vsnaps
 - d. Snapshots

2. NAS 4000s snapshot capability enables instant creation of multipurpose virtual replicas of production data without requiring a physical copy of the data.
 - ☐ True
 - ☐ False

3. NAS environments provide the user with information access at the _____ level.
 - a. File
 - b. Block
 - c. I/O channel
 - d. SCSI

4. Which of the following best describes HP OpenView Storage Mirroring?
 - a. Array-based data replication software that replicates data over Fibre Channel in either a synchronous or asynchronous mode.
 - b. Host-based application that performs remote replication over an IP LAN/WAN. Storage Mirroring runs on a WinTel server with Windows 2003/2000/NT operating systems.
 - c. Software that enables instant creation of multipurpose virtual replicas of production data without requiring a physical copy.
 - d. The ability to share a central storage system between Windows NT and UNIX servers.

5. _____ automatically takes dozens of point-in-time snapshots.
- a. Virtual Replicator
 - b. Secure Path
 - c. Volume Copy Shadow Service
 - d. HP OpenView Storage Mirroring
6. Which of the following is **not** a NAS benefit?
- a. Integration of file and block data
 - b. Unlimited scalability
 - c. Continuous data availability
 - d. Array-based file replication

Module 12 — Storage backup and archival systems

1. Which of the following is the leading cause of data loss?
 - a. Software malfunction
 - b. Viruses
 - c. Hardware or system malfunction
 - d. Human error

2. Which is the appropriate selling guideline to follow when positioning LTO and SDLT tape drives with customers?
 - a. If the customer has a preference for DLT or SDLT, persuade them to migrate to LTO.
 - b. If the customer does not have a preference, lead the sales discussion with either LTO or SDLT.
 - c. If the customer has a need for SDLT, close the sales discussion with SDLT.
 - d. If the customer has a preference for LTO, explain to them the benefits of SDLT.

3. Which of the following tape libraries supports up to four Ultrium 460 tape drives per module?
 - a. HP StorageWorks MSL6060
 - b. HP StorageWorks MSL6030
 - c. HP StorageWorks MSL5052DLX
 - d. HP StorageWorks MSL5052SL

4. The HP StorageWorks MSL5000 family supports the mixing of LTO and SDLT tape drives within the same library.
 - ☐ True
 - ☐ False

5. What customer need would you be exploring by asking the question: *“Are your backup systems all over the place and taking up valuable floor space?”*
 - a. Media management
 - b. Data protection
 - c. Interoperability
 - d. Storage consolidation

6. Which of the following describes the HP StorageWorks ESL9595L2?
 - a. SDLT 160/320 drives, up to 595 slots, up to 1728GB/hour native backup performance
 - b. Ultrium 460 drives, up to 322 slots, up to 432GB/hour native backup performance
 - c. Ultrium 460 drives, up to 595 slots, up to 1728GB/hour native backup performance
 - d. Ultrium 460 drives, up to 500 slots, up to 864GB/hour native backup performance

7. Which **two** of the following questions are most appropriate to ask when qualifying potential data archiving opportunities?
 - a. Are your servers having performance problems attributed to backup?
 - b. Are you contractually committed by regulatory requirements to backup data?
 - c. Are your system managers spending extra cycles managing disparate tape libraries?
 - d. Would you like to protect against losing files by performing scheduled snapshot backups?
 - e. Do you have large volumes of data that must be stored and accessible over a long period of time?

Module 13 — HP StorageWorks SAN interconnect solutions

1. Which of the following is **not** a SAN interconnect customer challenge?
 - a. Management of the storage ecosystem of Student Guide
 - b. Linking SAN islands
 - c. Connecting remote servers to the SAN for data access and backup
 - d. 24 x 7 data availability and access
2. Identify one way HP differentiates itself in the SAN interconnect market.
 - e. By offering leading edge- and director-class switches
 - f. By leveraging its experience in server products
 - g. By providing proven, continuously tested solutions
 - h. By fusing DAS and NAS
3. Which of the following descriptions applies to the Fabric Watch software?
 - a. Enables Fibre Channel private-loop devices in legacy environments to migrate to a fully scalable Fabric in a SAN
 - b. Monitors fabric-wide events, ports, SFPs (small form factor pluggables), and environmental parameters; permits early fault detection and isolation as well as performance measurement.
 - c. Assists SAN administrators with the configuration, monitoring, dynamic provisioning, and daily management of SANs
 - d. An intuitive and easy-to-use graphical interface that enables organizations to monitor and manage Brocade SilkWorm Fibre Channel Fabric Switches
4. Which of the following is a benefit of a SAN switch and director?
 - a. Frees server resources to conduct revenue-generating tasks
 - b. Allows workers to be more efficient without LAN bottlenecks
 - c. Aids in diagnosing problems to the individual LUN before device failure
 - d. Scalability in terms of port count, fabric, and manageability so customer growth requirements can be easily addressed

5. Which of the following is a SCSI-to-Fibre Channel bridge that connects SCSI tape libraries to a SAN?
 - a. San switch
 - b. iSCSI router
 - c. Network storage router
 - d. SAN director
6. Which of the following statements summarizes the HP strategy for IP storage?
 - a. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by measured exploitation of IP storage utilizing both FCIP and iSCSI
 - b. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by widespread adoption of IP storage utilizing both FCIP and iSCSI
 - c. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by widespread adoption of IP storage utilizing both iFCP and iSCSI
 - d. Enhance and extend ENSA by continuing to evolve Fibre Channel functionality and by measured exploitation of IP storage utilizing both iFCP and iSCSI
7. What is one of the benefits of HP iSCSI router?
 - a. Provides better availability than traditional routers
 - b. Allows customers to quickly and easily add “stranded” servers located on a metro- or wide area LAN to a Fibre Channel SAN for data access and backups
 - c. Allows workers to be more efficient without LAN bottlenecks
 - d. Encapsulates SCSI commands for routing to Fibre Channel networks
8. Which of the following is NOT a feature of the HP SAN interconnect strategy?
 - a. Provides seamless integration with software tools for management, ranging from network management to complete system management
 - b. Supports seamless expansion of tape libraries for additional flexibility within the data center
 - c. Provides a range of SAN connectivity options for customer business needs
 - d. Incorporates the industry’s leading infrastructure vendors into a comprehensive portfolio of SAN solutions

9. If a customer answers “yes” to the qualifying question, “*Would you like to consolidate stranded remote servers into an existing SAN?*” the most immediate solution for consideration would be _____.
- a. SAN Director
 - b. iSCSI Router
 - c. Fabric Switch
 - d. Network Storage Router
10. Which of the following is **not** a characteristic of Director-level interconnects?
- a. Developed for very large SANs
 - b. Designed to reside in the middle of a large SAN
 - c. Suitable for SAN deployments from entry-level to enterprise
 - d. Design minimizes loss of bandwidth from ISLs (inter-switch links)
11. Write the letter of the correct switch vendor below next to the corresponding switch.
- A. Brocade
 - B. McData
 - C. Cisco
 - B Edge switch 2/32
 - A SAN switch 2/16
 - C MDS 9120
 - B Core 2/64

Module 14 — HP OpenView Storage Area Manager

1. Which of the following best describes how IT managers often overestimate their storage array utilization rates?
 - a. Assume 70% rates when they are actually closer to 40–50%
 - b. Assume 80% rates when they are actually closer to 40–50%
 - c. Assume 80% rates when they are actually closer to 65%
 - d. Assume 65% rates when they are actually closer to 75–85%

2. Match the letter of the SAM business value to the corresponding description in the table below.

A. Operational efficiency	B. Service levels
C. Business flexibility	D. Complete service offering

<u>B</u> Billing and charge-back	
<u>A</u> Increased utilization rates	
<u>C</u> Modular, building-block architecture	
<u>D</u> SAM support services	

3. Which of the following most accurately describes where the SAM management software is installed?
 - a. HP-UX server
 - b. Windows 2000 or HP-UX server
 - c. Windows 2000 server
 - d. Windows 2000 server, or HP OpenView storage management appliance

4. Which of the following is not an appropriate qualifying question to identify a SAM requirement?
 - a. How do you manage your storage resources and infrastructure?
 - b. Do you have a single solution to manage multivendor, direct-attached and network storage, disk and tape, legacy and new storage?
 - c. Do you need to optimize cost?
 - d. Do you want to consolidate your direct-attach storage into a network-attached storage solution?

5. Which of the following SAM components tracks the costs associated with storage consumption?
 - a. Storage Allocator
 - b. Storage Accountant
 - c. Storage Optimizer
 - d. Storage Node Manager

6. HP recommends that you use which of the following for storage provisioning?
 - a. Storage Provisioner
 - b. Storage Allocator
 - c. Storage Builder
 - d. Either Storage Provisioner or Storage Allocator

Module 15 — HP OpenView Storage Data Protector and HP OpenView Storage Operations Manager

1. The HP OpenView Storage Data Protector Instant Recovery function uses tapes as recovery media.
 - ☐ True
 - ☐ False

2. One of Data Protector's key value propositions is that it:
 - a. Provides tape-based full and incremental backup protection
 - b. Provides I/O channel redundancy in the event of hardware failure
 - c. Is the only tool that integrates disk-based and tape-based recovery in a single product across multiple applications, operating systems and storage architectures
 - d. Is a low-cost alternative to expensive tape farms

3. All of the following HP OpenView Data Protector capabilities distinguish it from the competitors **except**:
 - a. Advanced remote clustering for major operating environments
 - b. Zero downtime backup and rapid recovery capabilities
 - c. Comprehensive HP worldwide services
 - d. Incremental backups

4. Which of the following best describes the Volume Shadow Copy Service?
 - a. Host-based data mirroring that allows for recovery from tape or disk
 - b. Host-based data mirroring that allows for recovery from tape only
 - c. Array-based data mirroring that allows for recovery from tape only
 - d. Array-based data mirroring that allows for recovery from tape or disk

5. With a zero downtime backup (ZDB) **tape backup** configuration, what happens to the replica storage?
- a. Moved to the backup medium; the replica storage version with its snapshots is not retained on a disk array (it is deleted) and is not marked for instant recovery, hence instant recovery is not possible
 - b. Not moved to the backup medium; the replica storage version with its snapshots is retained on a disk array and marked for instant recovery, hence instant recovery is possible
 - c. Moved to the backup medium; the replica storage version with its snapshots is retained on a disk array and marked for instant recovery, hence instant recovery is possible
 - d. None of the above
6. Which of the following is not recommended as a full data protection solution?
- a. Backup and incremental backups to MSA1000 drive array and then backup off-line to tape or optical libraries on-site or off-site
 - b. Full backup to tape and then incremental backup to MSA drive array
 - c. Backup and restore to and from MSA drive array only
 - d. Full backup to and restore from tape only
7. The Enterprise Level License of Storage Media Operations will support environments with up to _____ pieces of media.
- a. 2,000
 - b. 10,000
 - c. 50,000
 - d. Unlimited
8. The Storage Media Operations software can track online, offline, and offsite media.
- ☐ True
 - ☐ False

9. HP OpenView Storage Media Operations can support all of the following operations, **except**:
- a. Performing online backups
 - b. Enforces media retention and rotation policies
 - c. Ensures backup success by calculating backup capacity requirements and by preloading libraries
 - d. Tracks media regardless of location
10. The least favorable type of opportunity to sell Storage Media Operations is:
- a. UNIX, Linux, or Windows system environments
 - b. Customers who use Data Protector or any other leading backup application and needs a media management solution
 - c. Mainframe environments
 - d. Customers who are dissatisfied with home-grown media management tools

Module 16 — Enterprise Network Storage Services

1. When meeting with a customer there are many reasons why they would need and want Network Storage Services to support their storage requirements. Select two of these business reasons from the list below. Select **TWO**.
 - a. Industry trend of outsourcing IT operations
 - b. Control costs while enhancing their ability to maintain change
 - c. Optimized application performance, agility, availability, and efficiency
 - d. Maintaining a staff with storage services skills inside their company has the lowest risk and costs
2. Which three of the following describe the HP Network Storage Services Group's (NSSv) value proposition? Select **three**.
 - a. Cut operational costs
 - b. Cut downtime
 - c. Define role of IT organization
 - d. Speed time to market
3. HP Care Pack support services are positioned for which stages within a customer's storage services life cycle?
 - a. Design stage
 - b. Build and integrate stages
 - c. Integrate and manage stages
 - d. Manage and evolve stages
4. Storage Business Value Workshop and Storage Investment Justification Service are included in which of the following HP storage services groups?
 - a. Storage Solution Services
 - b. Strategic Storage Consulting Services
 - c. Storage Architecture Design Services
 - d. Storage Deployment Services

Module 17 — Enterprise storage competition

Learning check

1. HP has shipped more than the following percentage of the all the worldwide Open SANs during 2002:
20%
35%
50%
15%
2. Most of Sun's enterprise servers have high-end arrays as their mainstream attached product sold by
 - a. HP
 - b. Sun
 - c. IBM
 - d. EMC
3. IBM's high-end storage array is called
 - a. TSA
 - b. Shark
 - c. XEP
 - d. Enterprise Array Storage
4. Dell relies on its service business to make its profit on storage sales
☐ True
☐ False
5. Dell has a storage reseller agreement with
 - i. IBM
 - j. Sun
 - k. EMC
 - l. HP

Module 18 — Enterprise storage selling tools and resources

1. What the name given to HP packaged services?
 - a. HP ServiceCall
 - b. HP SupportPack
 - c. HP Care Pack Services
 - d. HP Prepaid Services

2. Which resource provides partners a secure website that allows access to key information as well as an avenue to communicate with HP via email?
 - a. HP Global Services
 - b. HP Business Link
 - c. HP Partnership Web
 - d. HP Storage Resource Center

3. What tool automates the configuration and pricing of storage systems?
 - a. CarePaq Configuration Kit
 - b. SalesBuilder for Windows
 - c. HP Configuration Tool
 - d. Network Storage Configuration Tool

4. What tool would you use to assist in designing a Storage Area Network?
 - a. HP StorageWorks Tool
 - b. HP Network Design Utility
 - c. HP SAN Sizer
 - d. SalesBuilder for Windows

5. Where can you go to find out about leasing services?
 - a. HP StorageWorks tool
 - b. HP Financial Services
 - c. HP SAN Sizer
 - d. HP Network Design utility