Disaster Tolerance and Data Availability

ESG472SG0303

student

guide

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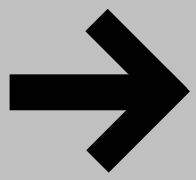

training

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Disaster Tolerance and Data Availability
Student Guide
March 2003

contents

Overview

Module 1 — Business Value of a Well-Planned Disaster Tolerance and Data Availability Plan

Module 2 — Using Virtual Replicator

Module 3 — Using Enterprise Volume Manager

Module 4 —Data Replication Manager Configuration and Failover/Failback

Module 5 — Case Studies – Classroom Discussion

Introduction

This course introduces you to applications and solutions that HP offers for enterprises interested in having data highly available and disaster tolerant. The course also describes software and hardware requirements for installing and configuring the solutions offered by HP.

Course Objectives

After completing this course, you should be able to:

- Define the business value of implementing a disaster tolerant, high data availability solution
- Using a case study, design and implement a disaster recovery solution using Virtual Replicator.
- Using a case study, design and implement a disaster recovery solution using Enterprise Volume Manager in a multi-operating system SAN
- Using a case study, design and implement a disaster recovery solution using Secure Path and Data Replication Manager in a multi-operating system SAN.
- Perform basic trouble shooting necessary to resolve problems that may be encountered when implementing these solutions.

Course Prerequisites

You should have successfully completed the following courses before attending this course:

- Compaq Storage Technologies or Compaq System Technologies
- HP StorageWorks Full-Line Technical Training (Web-based)
- HP Storage Software and Solutions Full-Line Technical Training (Web-based)
- Implementing HSx80 Storage Solutions
- Implementing SANworks Solutions (Instructor-led training)
- Implementing and Servicing Data Replication Manager

Websites

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

http://www.compaq.com/products/sanworks/drm/index.html

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

http://www.compaq.com/products/sanworks/secure-path/index.html

http://www.compaq.com/products/sanworks/commandscripter/index.html

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

http://www.compaq.com/products/sanworks/vr/index.html

business value of a well-planned disaster tolerance and data availability plan

module 1

Objectives

After completing this module, you should be able to:

- Explain the importance of business continuity for a business.
- Discuss the business value of a properly designed and executed disaster tolerance/disaster recovery solution.
- Explain the factors that should be considered when developing a disaster tolerant environment.
- Describe each of the storage software application solutions:
  - hp OpenView storage virtual replicator
  - hp StorageWorks enterprise volume manager
  - hp StorageWorks secure path
  - hp StorageWorks data replication manager

Business Continuity

In today's global economy—where online transactions are completed in seconds, email messages are delivered in minutes, and the business day never ends—technology users are coming to expect 24 x 365 access to virtually all IT-based business processes. When disappointed by a service interruption or an IT outage, users can be unforgiving.

Despite this reality, many organizations maintain an outdated approach to business continuity. While promising the world 24 x 365 service, they rely on reactive strategies that only provide for the recovery of business-critical processes and underlying IT assets after a service interruption occurs. As a result, they put themselves at tremendous risk of revenue loss, decreased profitability, brand erosion, legal liability, and other costs that can arise from service interruptions.

To ensure true continuity for core business operations, organizations need to take a more pervasive and proactive approach to continuity planning and implementation. Planning efforts must anticipate the significant changes—such as the growth of storage area networks (SANs), wireless commerce, and application service providers (ASPs) — that will continually reshape the IT environment during the next three to five years.

Trends and Drivers that Impact Continuity

	'80s	'90s	'00s
Business Focus	Traditional	Dot.com	e-Business
Requirements	Restore, Recover	High Availability	24 x 7, Scalable
Driven by	Regulation	e-Commerce	Competition
Magnified by	Disaster	Absence of "Bricks & Mortar"	Dependence on Computers
Recovery Expectation	Hardware Days/Hours	Hardware, Data Minutes/Seconds	Hardware, Data, Applications Minutes/Seconds
Decision	Optional →		Mandatory

Powerful forces that have transformed the business landscape during the last five years include globalization of the economy, deregulation of key industries, wide adoption of Internet technology, and the accelerating pace of change. Combined, these developments have profound implications for business continuity.

Expectations

Many technology users now expect 24 x 365 access to all IT-driven business processes, transactions, and interactions—whether that expectation is reasonable or not. Soon they will expect access by any device, including wireless phones and Internet TVs.

Access is not enough, however; speed is also important. Gartner Group reports that when response times for a website rise above 6 to 10 seconds, many users will consider a site unavailable and will leave. Gartner advises, “poor performance over a tolerance threshold should be considered downtime.”

In this demanding environment, the concepts of availability and continuity are being expanded to encompass the quality of the user or customer experience as well as the availability of the application.

In response to these increased expectations, enterprises have raised the bar for internal IT organizations and third-party communication service providers. They are now requesting service-level agreements (SLAs) that guarantee a specified level of performance and availability for IT infrastructure, including systems, networks, and—most recently—enterprise applications such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM).

The Impact of Downtime

As a growing percentage of applications come to be viewed as business-critical, manual workarounds cease to be a viable option. When the infrastructure or applications fail, a company can be instantly paralyzed.

In March 2000, a backhoe cut through a fiber optic cable operated by a major U.S. telecommunications carrier. When the carrier's backup systems failed, regional operations for an international airline came to a standstill for three hours, affecting 17,000 passengers and resulting in 130 canceled flights.

Depending on the type of application and scope of an outage, the cost of an interruption can run anywhere from tens of thousands of dollars to several million dollars an hour. Immediate and measurable costs typically include:

- **Lost revenue** — For example, from an e-commerce site or a flight reservation system.
- **Lost profit opportunities** — As in a commodities trading environment.
- **Reduced productivity for skilled employees** — Legal staff, design engineers, researchers and costly capital equipment and semiconductor or pharmaceuticals manufacturing equipment.
- **Costly emergency measures to restore normal operations** — For example, emergency infrastructure repairs and contracting for the use of a temporary infrastructure.

Subsequent costs may include rapid loss of share value, steep regulatory penalties, and legal liability as customers or business partners seek compensation for their losses. Intangible costs, such as brand erosion, can be equally devastating. Customer dissatisfaction with an airline, a cellular services company, or an online store can quickly translate into customer defections.

According to Forrester Research, 58% of first-time visitors to a website will not return if they experience a problem, and 85% of those who encounter a failure are likely to describe the experience negatively to others.

Defining Disaster Tolerance

Disaster tolerance is born of a discipline that looks at catastrophes from two perspectives: disaster avoidance and disaster recovery. Disaster avoidance is the disaster recovery task during which steps are taken to avoid disasters. Disaster recovery is the activity consisting of all tasks that are primarily performed to prepare for, avoid, and recover from disasters. It is the technological basis for the broader concept of business continuity.

When looking at disaster tolerance, consider the nature of the business. Some businesses, such as manufacturers or retailers, have tangible production and inventory issues, as well as the need to protect valuable business information. But some businesses are about protecting information; for example, banks, insurance companies, airline reservation organizations, and dot-com and dot-net companies.

If a fire hits a manufacturer, the issue is to protect the critical information resources—such as bills of material, formulae, or customer databases—so that business can resume as soon as possible. For a bank, the issue includes resuming support for transactions immediately and with uncorrupted data.

It is useful to consider disaster recovery along two dimensions:

1. Transaction centricity and data centricity
2. Recovery point and recovery time

Transaction Centricity and Data Centricity

This first dimension refers to how information is used in the business and what aspects of the business model require the most protection. Does the business need to protect its ability to continue transactions without interruption or does it need to protect its business data so it can resume business as quickly as possible? Certainly, all organizations share both concerns at some level, but ordinarily one is more dominant than the other.

Transaction Centricity

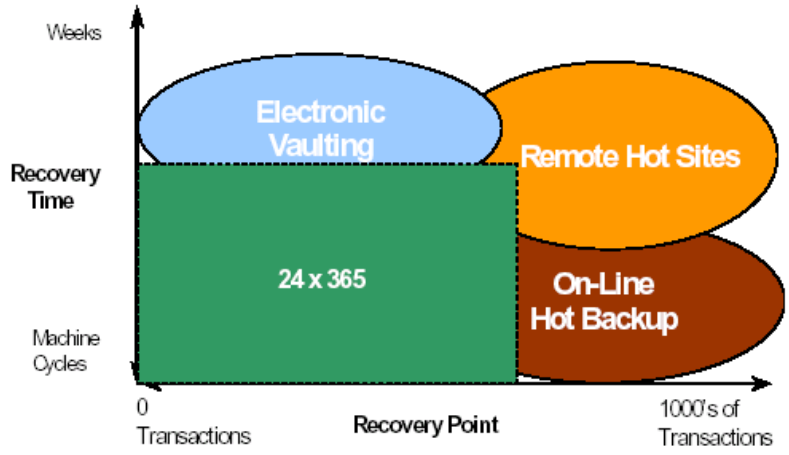
Continuous computing is primarily a transaction-centric implementation of high availability technology. It is employed in environments in which the loss of transaction capability or the loss of the data integrity is completely unacceptable. Examples of transaction-centric businesses include financial and telecommunication companies.

Data Centricity

Disaster tolerance is primarily a data-centric model designed to ensure that data is not lost if a catastrophe occurs at a computing location. A disaster tolerant system consists of multiple sites that are sufficiently separated so as to ensure that a disaster at the primary location does not directly affect a secondary location.

Disaster tolerant systems are deployed in a variety of designs, ranging from a basic level of backup and restore to remote back up, electronic vaulting, and online hot backup. Continuous computing and disaster tolerance are frequently combined to ensure uninterrupted data processing and complete operational continuity in the event of a major catastrophe.

Recovery Point and Recovery Time



The second of the two dimensions is recovery point and recovery time. Recovery point is most important in data-centric operations where the loss of data is unacceptable. Recovery time is most important in transaction-centric operations where real-time continuity is key.

Recovery Point

Recovery point refers to the amount of acceptable information loss in the event of an incident.

- Is it tolerable for transactions to cease with little or no potential to roll back to incomplete ones?
- Is the loss of the most recent data a reasonable risk?

If the answers to these questions tend to be "yes", then the recovery point is not a major concern. The less loss that is acceptable, the more important the recovery point becomes.

Recovery Time

Recovery time refers to the interval between the time the incident affects the system and the time the system returns to operation.

- Is it essential that users notice no interruption at all?
- Must transactions in flight go to completion without stopping?
- Is some period of no operation time, measured in anything from seconds to hours, a reasonable compromise?

How these questions are answered will depend on your business model and risk analysis.

Understanding the Needs of the Business

To determine a customer's priorities and needs, questions that should be answered include:

- Does the business model point primarily to the need for fast recovery, recovery to the exact state prior to the failure, or both?
- What is the impact on operations as measured by a recovery point standard?
- If the business does not resume processing right where it left off, will it be merely inconvenient, seriously damaging, or catastrophic?
- What is the most effective and efficient method to use to recover the information?
- What is the impact on business measured in recovery time?

Transaction-centric models such as a financial exchange that handles billions in trades must not lose or delay a single transaction. An air traffic control system cannot afford to falter for even a fraction of a second.

On the other hand, back-office operations that tend to be more data-centric, such as inventory management, general ledger accounting, or payroll, can withstand some interruption in time. However, when that interruption is concluded the data must not be lost. System activity must pick up from exactly where it left off. This is an example of a recovery point. In extreme cases it is an example of disaster tolerance.

The continuous computing and disaster tolerance strategy used depends on your assessment of the recovery point and recovery time. Each business must evaluate its distinctive needs in the context of its model, the risk it is willing or able to take, and the economics involved.

Consequences of Disaster

A key issue in designing a disaster tolerant system is gaining a clear understanding of the consequences that might be experienced if a disaster occurs. Consequences can include human tragedy and the loss or damage of property. From a business perspective it could mean the inability to continue in business or the destruction of some vital business processes. It also could mean the loss or damage of key business information, the disruption of ongoing projects, the loss of business focus, or the loss of customers and business.

Financial Factors

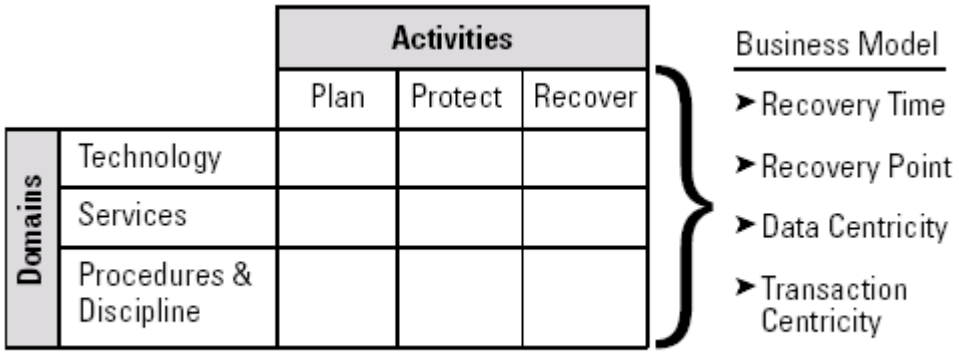
The ramifications of IT system failures are difficult to quantify without expert analysis, however, you can calculate the financial implications of a threat. The perceived cost of failure will be higher with some organizations than others. The estimated cost of downtime also affects the budget allocation for disaster avoidance and recovery.

Building a Disaster Tolerant Environment

A disastrous event can be quite extensive and dramatic, or a relatively small, local occurrence. Nevertheless, accidents, fires, wind and water damage, floods, storms, earthquakes and hurricanes, power outages, crime and civil unrest, and malicious attacks are all potential hazards for almost every organization.

The majority of businesses avoid full-blown disaster scenarios through planning and preparedness. Security systems, and contingency plans are inherently more reliable than they used to be.

The complexity of current IT infrastructures means that if a failure occurs it may not simply be a localized problem, but may have far reaching implications.



Consider the design of a disaster tolerant environment from a systemic and holistic approach, as illustrated in the preceding table. In the chart, the three vertical components are the domains of concern:

- Technology
- Services
- Procedures and disciplines

These represent the three points of vulnerability as well as the tools that are required for a truly disaster tolerant environment.

The three horizontal components are called the activities of concern:

- Plan
- Protect
- Recover

These are all considered in the context of recovery point, recovery time, data-centricity, transaction-centricity, and the business model. To achieve the appropriate level of disaster tolerance desired, each domain must be addressed for each activity.

Domains of Concern

- **Technology**
  - Systems, equipment, software, network, data, storage, power, and environment
  - These are the physical and logical components that make up the IT and network environment. As you consider these components, look not only at their technical vulnerabilities, but also at the changes that might be needed to survive at the level of disaster tolerance required.
- **Services**
  - Remedial, preventive, service providers, third party evaluations and reviews, and off-site personnel
  - These are the services that support the technology and its implementation. They may consist of traditional break-fix, periodic analysis and evaluation, preparedness, system planning and migration, change management, and alternative resources in the event of a failure of parts.
- **Procedures and disciplines**
  - Internal rules, policies, recovery plans and practices, cross training of personnel
  - These are the internal practices implemented to manage the operation. Not only are the day-to-day procedures important, but change management procedures and documentation are also critical. These are the procedures and disciplines that must be in place to protect and recover data within the recovery point and recovery time.

Activities of Concern

The activities needed to make the disaster strategy a reality, plan, protect, and recover, are in the horizontal axis of the Domains and Activities table. This shows that there is a process for each of the domains of concern that begins with a plan, then the protection that enables the plan to succeed, and finally the recovery activity itself, if and when an incident occurs.

Plan

Planning requires a thorough self-examination—understanding the model, goals, and needs of the organization along all three domains of concern. This process might require the assistance of an outside resource with an objective point of view.

During this phase, consider how the planning will affect and be incorporated into the technology, services, and operational procedures. Key to the plan are the following questions:

- **What is the business**? — What is the basic business model, how is revenue generated, how are products and services delivered, what are the related space needs, economics, data needs, customer characteristics, and supply chain? Planning describes all of the elements that make up the core business and identifies prime dependencies.
- **What are the risks compared to the consequences?** — This is an important stage of investigation to determine the answers to a number of key questions. What is the likelihood of a particular type of event? What is the expected result if it should occur?
- **What will the organization do?** — After the analysis is completed, it is time to make decisions. After you understand which causes of downtime are of most concern and which technologies are most at risk you can begin analyzing the total system environment and design the right disaster tolerance strategy. The level of protection needs to be decided, the method of protection and restoration needs to be planned, the technologies, services, internal procedures and disciplines need to be acquired, prepared, or otherwise arranged for.

Related Factors

Analyzing and defining the requirements for a disaster tolerant environment that meets the unique needs of the business is not a trivial process. When also considering solution deployment, and the task can seem overwhelming because other factors must be considered, such as:

- **Affordability —** Is the cost of purchasing, implementing, or managing the solution consistent with the operational loss you must prevent?
- **Manageability —** Does the organization have the knowledge and resources necessary to manage the solution over the long run?
- **Service and Support —** What level of service and support is available? Is the infrastructure in place to support the solution reliably and affordably—wherever it is located?

Protect

The protection stage refers to the acquisition, deployment, and operation of systems, resources, and procedures that are used to implement and support the plan. These technologies, services, and procedures must be in place for the plan to succeed. Consider them as business continuity solutions.

Questions to ask when developing protection include:

- What are the risks to the technology and data?
- What technology should be deployed? How should it be deployed to address or minimize the risk?
- In what manner and how frequently should testing be done to ensure that the system can meet the demands of anticipated disasters? Examples of tests are disaster drills, system health checks, backup verifications, and full disaster recovery tests.
- How will the services provided be internally and externally monitored to ensure that they continue to meet the needs for which they are designed?
- How will changes be managed and documented?
- What contingencies are in place to address the catastrophes being planned for?

It may be useful to logically separate the questions into those that deal with providing database backup and restoration and those that address traditional high availability.

Database Backup and Restoration

Database backup and restoration deals with the technologies, architectures, and internal procedures that ensure that when a disaster occurs, the critical business information is kept safe and available in an easily restored manner.

The assurance usually involves some form of off-site backup, real-time mirroring, periodic copying, or synchronous hot backup. Internal resources can provide these solutions or it can be supplied by third-party backup and restore companies. But key to these solutions is the need for rigorous discipline in following procedures.

High Availability

The organization also needs to consider ways to keep its computer and network systems working at the minimum level needed to achieve their operational goals. The key attribute of these systems is redundancy.

Clusters, redundant networks, and mirrored remote systems with failover capabilities are just some of the considerations. If a thorough examination of the entire IT environment is undertaken, weak links may also be found in the parts linking components together. For example, the system might have redundant access circuits coming into only a single point in the building.

Recover

Recovery is the final aspect of disaster tolerance that ensures business continuity. The goal is for all your planning for technology, services, and procedures result in recovery exactly as expected.

The recovery phase addresses the set of technologies, services, and procedures in the disaster tolerance plan that would be triggered if a catastrophe occurred and the recovery plan had to be implemented. The recovery phase is a key factor, because all of the plans and technology mean nothing if not implemented when needed.

In planning the recovery aspects, consider:

- Service agreements for rental or replacement equipment
- Service agreements for temporary hot sites
- Service agreements for mobile containers and data centers
- Plans for the rapid release of vaulted data
- Staffing contingencies for backup sites and the activities required to turn over operations to those sites
- General recovery and restart
- Cutting back to whatever replacement or repaired operation sites are implemented
- Periodic drills

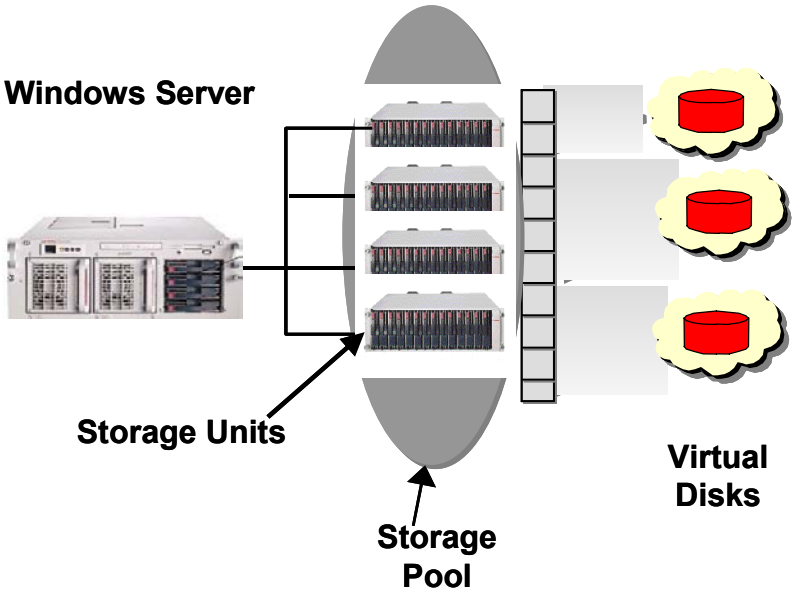
Storage Software Solutions

HP offers an array of business continuity and storage virtualization products that help companies prepare for disasters and increase the availability of their data.

The software products we will discuss in this course are:

- hp OpenView storage virtual replicator
- hp StorageWorks enterprise volume manager
- hp StorageWorks data replication manager
- hp StorageWorks secure path

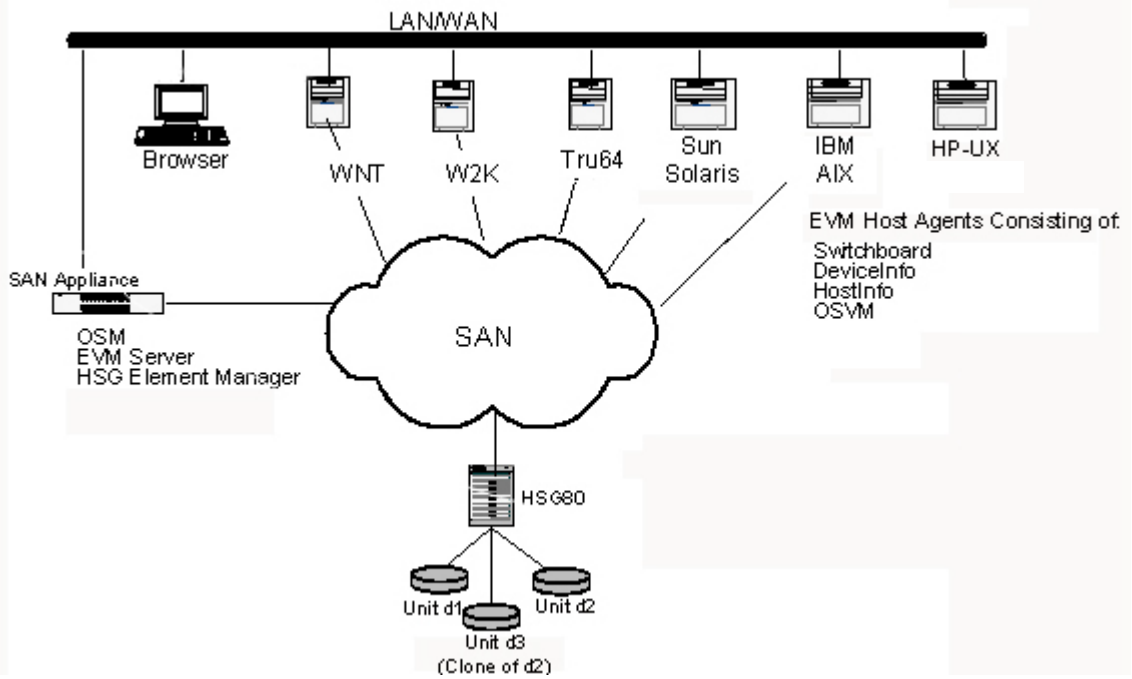
hp OpenView storage virtual replicator



HP OpenView Storage Virtual Replicator enhances and simplifies storage management for Windows NT and Windows 2000 environments. Customers can pool physical storage and create high capacity virtual disks tailored to the requirements of their production environment. Virtual disk space can be allocated as needed, allowing customers to respond quickly to changing storage capacity requirements. Through virtualization, online volume growth, snapshot and management features, the software complements the standard capabilities within the operating system.

Virtual Replicator provides the ability to create instant, virtual replicas or snapshots of production data without having to physically copy it. A snapshot, which looks exactly like the original disk from which it was derived, takes seconds to create and allows customers to perform backups and restores with minimal impact to users and applications. Customers can schedule automated snapshot backups using the integrated policy-based scheduling and scripting features.

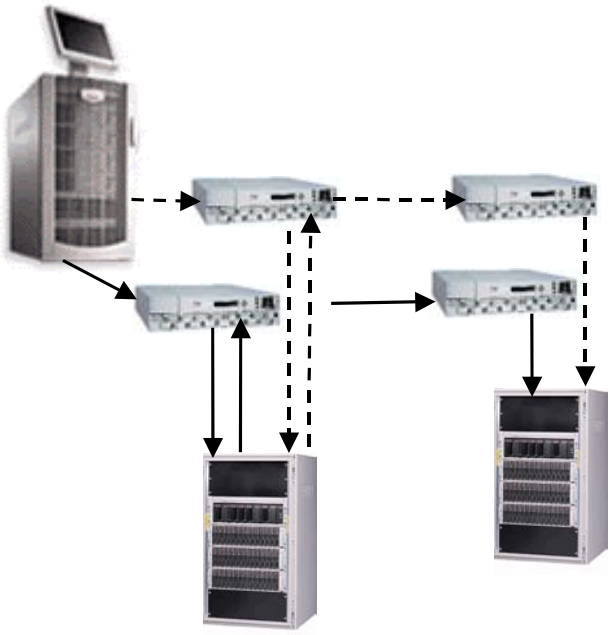
hp OpenView enterprise volume manager



HP StorageWorks Enterprise Volume Manager (EVM) is a Management Appliance-based application that manages controller-based clone and snapshot operations. Clones and snapshots are point-in-time copies of volumes that can be used to virtually eliminate the application downtime required for system backups and to facilitate other data center tasks. EVM addresses the need for business continuance by running the backup operations as a parallel process to normal applications processing.

EVM is designed for customers who do not want to or cannot disrupt their computing operations with management activities such as backup. With the growth of data, traditional backup operations cannot be completed in a backup window. EVM virtually eliminates the need for a backup window by allowing for non-disruptive backup and recovery operations. Backing up from a clone or snapshot in the background allows 24x365 operations. EVM also provides copies of data for operations such as data mining and warehousing, testing, and work distribution.

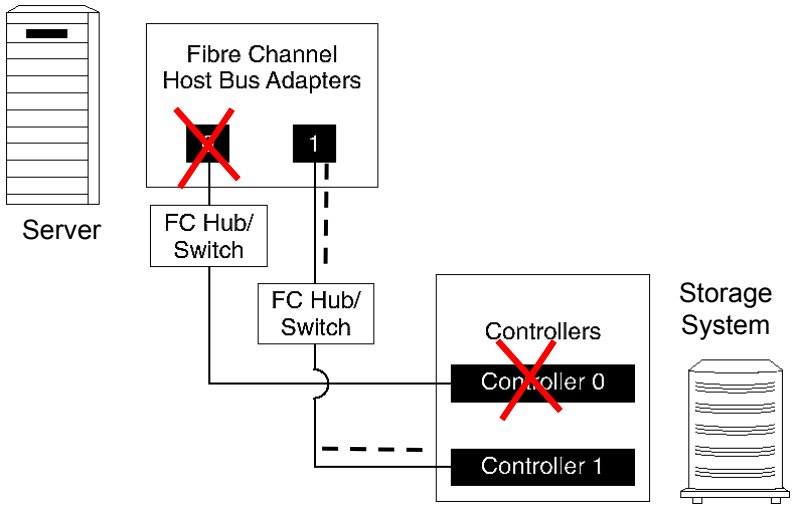
hp StorageWorks data replication manager



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

The StorageWorks RAID Arrays running Data Replication Manager can replicate data up to 100 km by means of direct Fibre Channel links at full Fibre Channel speeds (100 MB/s), connect SAN islands by means of a fiber optic Wave Division Multiplexing in a Metro public or private network, or go unlimited distances with Fibre Channel over IP networks and Fibre Channel-to-ATM gateways.

hp StorageWorks secure path



HP StorageWorks Secure Path high-availability multipathing software products provide continuous data access from RAID Arrays to host servers running the Windows 2000, Windows NT, Sun Solaris, Novell NetWare, IBM AIX, and HP-UX operating systems.

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

Learning Check

1. Define business continuity.

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2. What is the business value of a properly designed and executed disaster tolerance/disaster recovery solution?

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3. What are some of the factors that should be considered when developing a disaster tolerant environment?

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4. What products does HP offer to help create a disaster tolerant environment?

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   .....

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Objectives

After completing this module, you should be able to:

- Define solutions for Virtual Replicator.
- Review one case study that uses Virtual Replicator in a solution.

Overview

This module is divided into two sections. The first discusses solutions relating to Virtual Replicator. The second presents sample case studies that describe the use of Virtual Replicator in a "real world" environment.

Solutions for Virtual Replicator

Two solutions using Virtual Replicator are:

- Virtualized Storage Management for Microsoft Exchange 2000
- Virtualized Storage Management for Microsoft SQL Server 2000

Virtualized Storage Management for Exchange 2000 and Virtualized Storage Management for SQL Server 2000 extend the leadership position HP maintains in deploying Microsoft Exchange 2000 and Microsoft SQL 2000 environments by maximizing Exchange and SQL availability through rapid recovery and online storage growth capabilities.

Through the integration of Virtual Replicator and customizable scripts, you can perform a quick, complete, and automated recovery of your Exchange and SQL environment. By using a snapshot of the application environment, you can resume full operation of your application server environment in minutes. Therefore, this solution increases your level of data protection by providing an additional, extremely rapid recovery alternative to restoring from tape.

INTERNET For more information regarding these solutions, visit the storage website at **http://www.compaq.com/products/sanworks/virtualization.html**

Solution Components

The Virtualized Storage Management solutions for Exchange 2000 and SQL 2000 consist of four basic components:

- **Microsoft Exchange 2000 or SQL 2000**

  Each application can be configured on any Windows 2000 server with multiple network clients, and can use a Microsoft cluster configuration for improved application availability. The application servers own the storage groups and databases, which are stored on virtual disks, sharing available disk capacity across the SAN or network.

- **Virtual Replicator 3.0**

  To provide the storage virtualization function and the ability to create snapshots of virtual disks, each application host requires a Virtual Replicator license. In a clustered environment, each node connected to the server instance also requires a Virtual Replicator license.

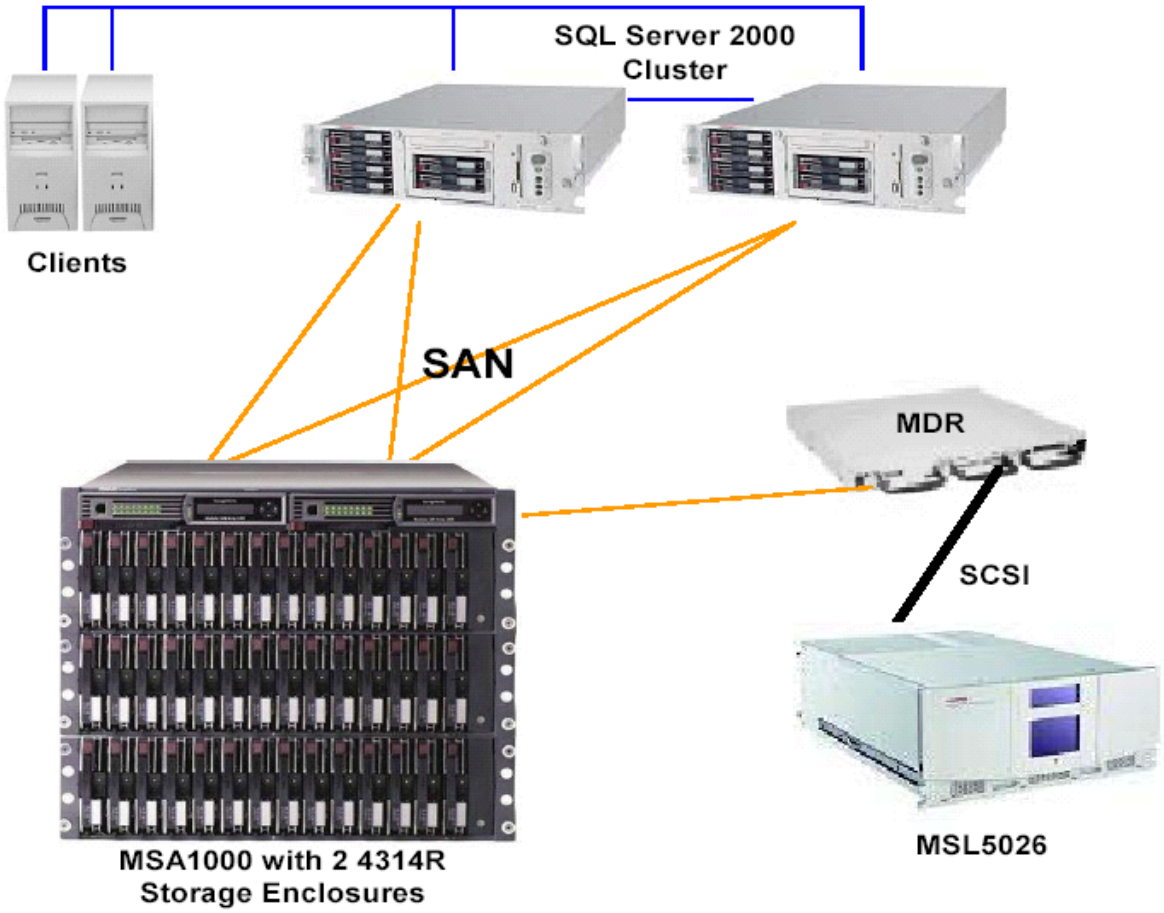
- **Disk Storage**

  The solution configurations can operate using direct-attached storage and any other Fibre Channel array controller. All disk storage devices on the network may be considered part of the available storage pool and can be used to create virtual disks. The solutions can operate with multiple storage devices, as long as the devices are available to the specific application host. Existing disk storage can be used without any modifications.

- **Tape Backup**

  A tape backup device and suitable backup software configuration are not required for this solution, but are highly recommended. If you already use a suitable tape backup configuration and have a pre-existing backup policy and schedule, then these solutions are easier to implement. This solution easily integrates into any preexisting backup configuration.

Test Configuration



Sample SQL Server 2000 configuration

The preceding diagram presents a typical SQL Server solution configuration. The configuration may be modified to meet specific customer requirements. The SAN configuration, although recommended for improved performance, is not a core requirement for successful operation of this solution.

The Virtualized Storage Management test recreates a subset of a SQL Server 2000 user environment. The test configuration consisted of clustered (active/passive) SQL Server 2000 application servers attached via Fibre Channel to a *StorageWorks* MSA1000 storage array. The storage array was configured using RAID 1+0 for optimum data protection.

Test Configuration (continued)

The basic operating components of the test configuration include:

- **Clients** — Workstations running a TPC-C benchmark load generator application, to simulate users.
- **Application Servers** — Clustered ProLiant servers loaded with Microsoft SQL Server 2000, StorageWorks Secure Path 3.1B for Workgroups (StorageWorks Secure Path 3.1a for StorageWorks HSG80 array configurations), and Virtual Replicator 3.0 software.
- **Enterprise Storage** — StorageWorks MSA1000 based disk array with 1.5TBs of disk storage capacity.
- **Backup** — Enterprise Backup Solution—SAN attached StorageWorks MSL5026SL SDLT library and VERITAS Backup Exec 8.6 backup software.
- **Application Server Configuration**
  - (2) ProLiant DL380
    - **Hardware**

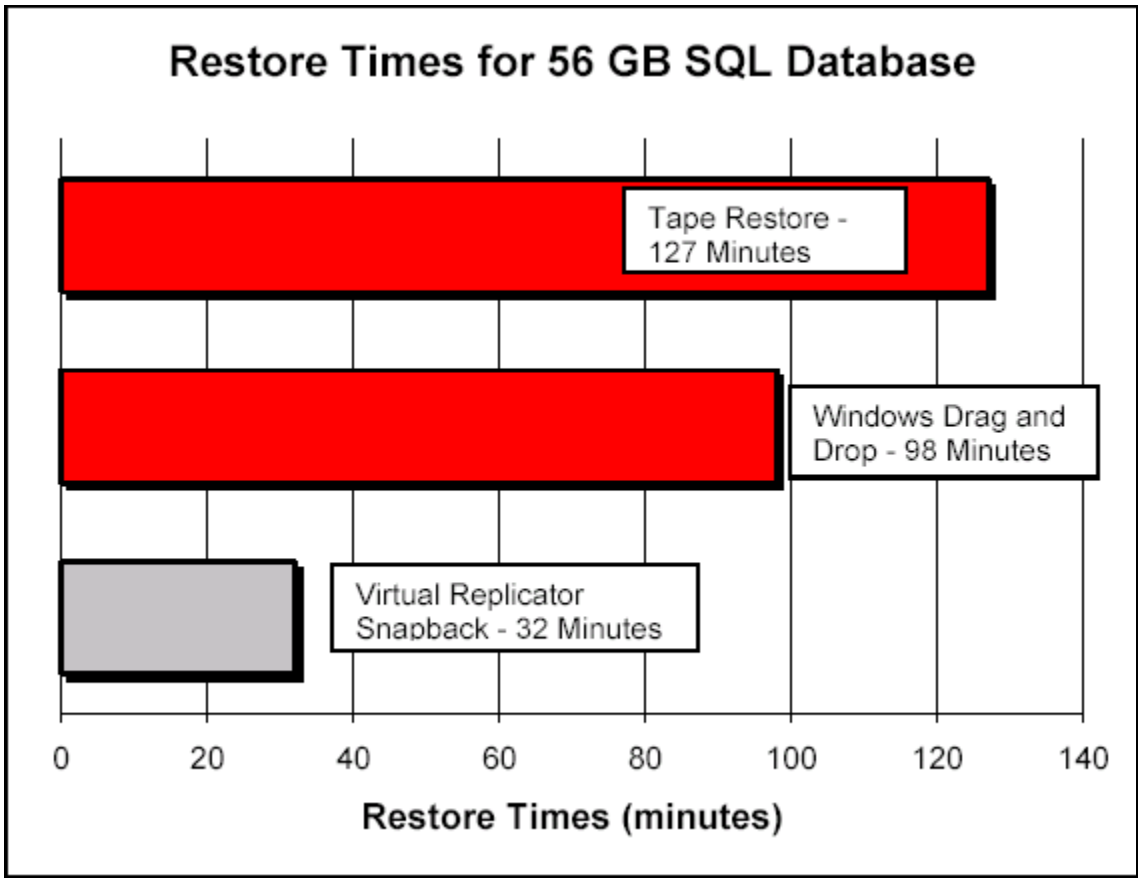
      (2) Pentium III, 1 GHz Processors – 512k level 2 cache (256 per processor), 2 GB RAM, (2) 18 GB Ultra3, 15k rpm drives (Operation System and SQL Application)
    - **Software**

      Microsoft Windows 2000 Advanced Server (Service Pack 2), Microsoft Cluster Server – MSCS, StorageWorks Secure Path 3.1b for Workgroups, Microsoft SQL 2000 Enterprise Server (Service Pack 1), Virtual Replicator 3.0 (with Import Unit Patch for clusters), StorageWorks Modular SAN Array 1000 Support Software
- **Enterprise Storage Configuration**
  - StorageWorks MSA1000 Enterprise Array with Dual Controllers
  - (2) 2 Gigabit StorageWorks MSA Fabric Switches
  - Dual port Fibre Channel I/O module
  - (2) 4314R disk shelf (single bus)
  - 36 GB 10000rpm U3 disk drives
- **Database Configuration**

  SQL Server 2000 database size of 200 GB spread over 3 virtual disks of a total capacity of 212GB. Two pools were used, one for the data volumes and one for the logs.
- **Load Generating Application**

  Microsoft TPC-C Benchmark Kit for SQL

Test Results



The preceding graph shows the backup and restore times for a 56GB SQL database file using various methods. The graph shows how the Snapback feature in Virtual Replicator can minimize the restoration process. The restore from Snapback, derived from a snapshot size that was approximately 25% of the 56 GB parent virtual disks, resulted in a significant improvement over typical database restore alternatives.

Case Study — Fun Furniture, Inc.

Decision Factors

Fun Furniture needs a solution to meet the following needs:

- Twenty percent annual storage growth rate
- Shortened backup window to minimize downtime
- Low-cost solution

Summary

Fun Furniture, Inc. (a fictional company) is the nation's largest distributor of contract office furniture, supplies, and industrial equipment. The company relies on a StorageWorks SAN and Virtual Replicator software to streamline operations and improve the reliability of its information systems.

Following years of successful customer service, and with a long list of happy customers, St. Louis-based Fun Furniture, Inc. found itself struggling to manage the explosive business growth. Thanks to an innovative sales strategy and high-quality customer-service programs, revenues from the office equipment, supplies and industrial equipment business surged twenty-fold in the last decade. While that was great news for the company's bottom line, it created major challenges for its information systems—particularly in the area of data storage.

"We began with relatively light data-storage needs," says Fun Furniture's senior network engineer. "Since then, our storage requirements skyrocketed."

Fun Furniture found the solution to its problems: a SAN from HP. A StorageWorks Modular SAN Array (MSA1000) system and Virtual Replicator software anchor the new storage environment.

Solving Present and Future Problems

The engineer believes that IT solutions must solve present and future problems. With a multi-year growth rate of 20%, he took great care to select a data-storage environment that would serve the company well for many years to come.

Fun Furniture had to consider the past as well. Due to the demands of its legacy accounting system, which required users to exit the system during backups of accounting data, partners and employees could not access some business-critical systems for seven hours each night. Because Fun Furniture does business in multiple time zones and needs to run 24x365, this created an unacceptable problem.

Virtual Replicator solved the problem by dramatically reducing the time required for backup and restore functions. The software allows virtual pooling of physical storage resources and enables Fun Furniture to create instant, snapshots of production data without having to physically copy the data to tape. Fun Furniture can back up and restore its data with minimal impact to users and applications.

“HP storage software solutions dramatically lower the cost and complexity of storage management,” says the engineer. "It would not matter if we had 100GB or 10TB of data—Virtual Replicator lets us take a snapshot in less than a minute. Then we can let everyone use the system while we back up the snapshot to tape in the background.”

Besides its usefulness during backup and restore operations, Virtual Replicator also aids in data-processing activities that impact the performance of production applications. For example, if an analyst in the marketing department is running data mining or reporting, he or she can take a snapshot of the pertinent data rather than querying the live database directly. “The Virtual Replicator point-in-time snapshot capability is critical to our operation,” adds the engineer.

Fun Furniture’s current storage strategy is to use the MSA1000 system as a common storage pool, supporting six ProLiant servers. Other storage in the SAN includes dual HSG80 Fibre Channel controllers in an MA8000 to streamline the performance of data I/O operations. The ProLiant servers run the Microsoft Windows NT network operating system, which Fun Furniture will soon upgrade to the Microsoft Windows 2000 platform. The MSA1000 solution is entirely redundant, including two StorageWorks Fibre Channel Loop Switches and a dual Fibre Channel storage hub.

Flexible Technology for Multiple Tasks

Fun Furniture backs up the SAN using the Enterprise Backup Solution, which consists of a tape library (model TL891) with dual drives running VERITAS Backup Exec software. Currently, 365GB of storage capacity (out of a total of 1TB) is connected to the SAN.

As time permits, the engineer plans to migrate 100% of Fun Furniture's data to the StorageWorks MA8000 system so it may be handled easily from the StorageWorks Command Console.

"As soon as we transfer all the data to the SAN, I will be able to manage all my corporate data from one console," he says. "Allocating storage capacity for new products and services is quick and simple. It only takes a few keystrokes."

Currently, Fun Furniture attaches a variety of ProLiant servers to the SAN. The company uses these servers to run their website, a Microsoft SQL Server database, Citrix MetaFrame, and other business-critical applications.

Business results

- The StorageWorks open architecture supports current and future storage requirements resulting in cost savings and investment protection.
- Virtual Replicator software eliminates seven hours of downtime during nightly backup operations, significantly increasing employee productivity, data accessibility, and customer service.
- The scalability of Virtual Replicator supports 20% annual growth rate.

Components

Hardware

- StorageWorks MSA1000 system
- Redundant StorageWorks HSG80 Fibre Channel controllers
- Two StorageWorks Fibre Channel Loop Switches
- Dual Fibre Channel storage hubs
- StorageWorks Enterprise Backup Solution
- StorageWorks TL891 tape library with dual drives
- ProLiant 8500 8-Way servers
- ProLiant server models DL360, DL580, and 5500

Software

- Virtual Replicator
- StorageWorks Command Console
- Microsoft Windows NT server operating system (soon to be upgraded to the Microsoft Windows 2000 server operating system)
- Microsoft SQL Server
- Microsoft IIS 5.0
- Microsoft Enterprise Server 4.0
- Microsoft Windows 2000 Advanced Server with MSFT SQL 2000 sp1
- VERITAS Backup Exec
- ACCPAC SBT Pro Series 5.0i accounting software

Learning Check

1. What solutions are offered that uses the Virtual Replicator?

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2. Using the case studies for this module, what business value did Virtual Replicator add the respective companies?

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using hp StorageWorks enterprise volume manager

module 3

Objectives

After completing this module, the student will be able to:

- Define solutions for HP StorageWorks Enterprise Volume Manager.
- Review one case study that uses Enterprise Volume Manager in the solution.

Overview

The structure of this module is divided into two sections. The first discusses solutions offered by HP relating to Enterprise Volume Manager. The second discusses a sample case study that describes the use of Enterprise Volume Manager in a business environment.

Solutions for Enterprise Volume Manager

Three solutions using the Enterprise Volume Manager are:

- Non-disruptive Backup Solutions
- Rapid Restore Solution for SQL Server 2000
- Oracle 9*i* Backup/Restore Solution

INTERNET For more information regarding these solutions, or to download the associated guide for the respective solution, please visit **http://www.compaq.com/products/sanworks/bc.html**

Non-disruptive Backup Solution

The Non-disruptive Backup Solution is an HP NonStop eBusiness solution designed for businesses that need to run 24x365—especially those that rely on e-commerce, Oracle databases, or Microsoft Exchange. This integrated storage solution solves the two major business problems associated with backup and recovery:

- Shrinking backup window
- Complexity of backup

The Non-Disruptive Backup Solution is a combination of products and services that provide a complete backup infrastructure for both storage area network (SAN) and SCSI direct-attached secondary storage environments. Intended for users of StorageWorks RA8000, MA8000, EMA12000, and ESA12000 systems, it provides a qualified, characterized backup. The solution manages the snapshot and cloning features of the StorageWorks RAID array using Enterprise Volume Manager, and includes customizable application and backup scripts for quick implementation.

The Non-disruptive Backup Solution is qualified, fully integrated configurations of hardware, applications, backup software, and services that allow businesses to perform backups with minimal disruption of production systems. It provides a backup infrastructure for both SAN and SCSI (direct-attached) secondary storage environments, resulting in an end-to-end data protection environment for primary and secondary storage.

The solution provides an integrated storage and backup solution for medium to large companies that depend on e-commerce, finance, online transaction processing, mail and messaging, and business-critical applications.

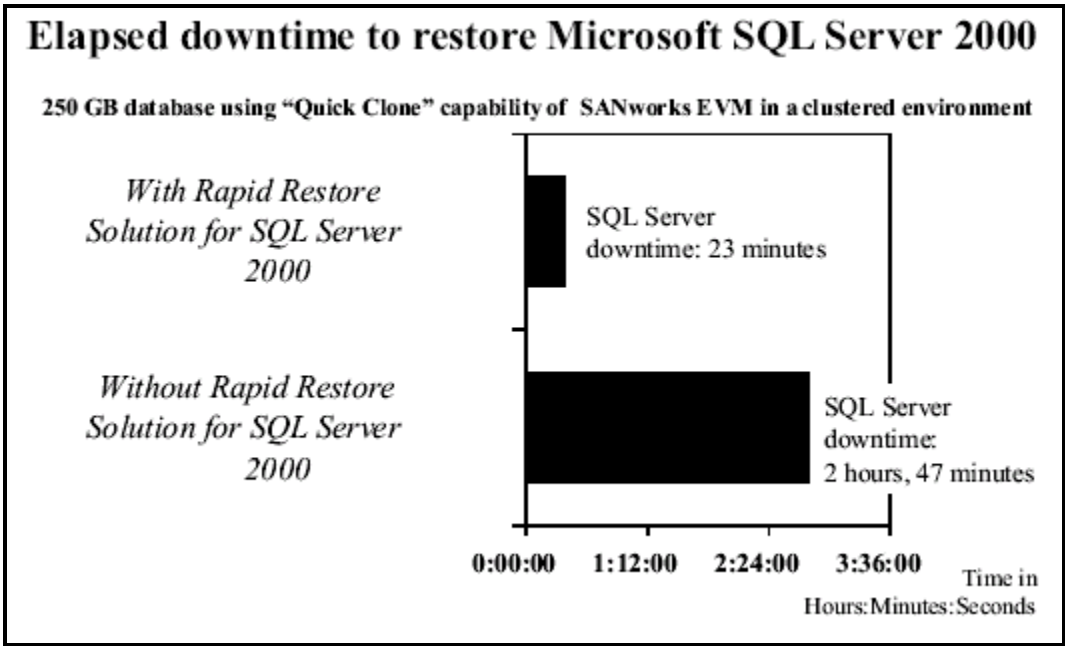
EVM lets you create, in background mode, independently addressable volumes for open system information storage. The volumes are virtual copies of active production volumes. This parallel processing enables you to redirect workloads and perform non-disruptive backups while maintaining normal business operations.

EVM can be used to meet business continuance requirements by minimizing application downtime. Because all backup operations are done on the clone or snapshot rather than on the live data, the performance impact on the production system is minimized during the backup process, and application availability is enhanced.

Rapid Restore Solution for SQL Server 2000

The Rapid Restore Solution for SQL Server 2000 is a qualified, fully integrated configuration of hardware and software that provides a SAN-based backup and restore infrastructure for end-to-end data protection with minimal downtime for Microsoft SQL Server 2000 applications. To achieve these results, the Rapid Restore Solution for SQL Server 2000 leverages the capabilities of StorageWorks RAID arrays configured with HSG80 controllers, the EVM, and the StorageWorks Enterprise Backup Solution (EBS).

The Rapid Restore Solution for SQL Server 2000 relies on the StorageWorks HSG80 controller and EVM to create a BCV, which acts as a "third mirror" in a mirrorset on the StorageWorks RAID array. Using the capabilities of EVM, a BCV can be broken off from the mirrorset, a process that involves removing a disk from a mirrorset. The BCV is then mounted on any server managed by EVM, so that rapid backup and restore operations can take place across a SAN.



Tests conducted on the Rapid Restore Solution for SQL Server 2000 found that a 250GB SQL database can be restored in 33 minutes with only 23 minutes of application downtime. These results are a dramatic improvement over the nearly 3 hours required for recovery when a BCV approach is not employed.

Oracle 9*i* Backup/Restore Solution

The Oracle 9*i* Backup/Restore solution has been tested in an Oracle 9*i* environment for backup and recovery of data from a Windows 2000-based application. Because Oracle 9*i* databases are typically quite large, backup and restore operations can be disruptive to applications and users. By leveraging the capabilities of EVM 2.0 in a Fibre Channel SAN environment, very large Oracle 9*i* databases spanning multiple storage subsystems can be backed up or restored quickly and with minimal disruption to production activities.

In laboratory tests using a Microsoft Windows 2000-based simulated banking application, HP demonstrated significant application uptime benefits when using EVM 2.0 with StorageWorks EBS to replicate and back up an Oracle 9i database. Tests imposed heavy simulated workload on a 23GB Oracle database, configured with RAID 1+0 storage arrays.

The clone backup produced an average response time of approximately 82 ms—an acceptable response time for users. The response times were nearly 30% faster than when backup routines were conducted without using EVM 2.0.

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

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

Case Study — NewCo Life Company

Decision Factors

NewCo Life Company needs a solution to meet the following needs:

- Streamline the efficiency of its batch and backup processes
- Improve overall data-processing efficiency
- Increase storage capacity

Summary

NewCo Life Company (a fictional company) provides efficient service and quality life, health, and annuity products to its policyholders in 40 states.

Information-intensive companies—in industries such as financial services and insurance—face the constant challenge of supplying fast and efficient data-storage systems. NewCo Life put an end to data-throughput bottlenecks by implementing storage solutions from HP. A HP Global Services consultant showed NewCo Life how the EVM and other StorageWorks tools could dramatically and positively change tape backup and batch processing.

“HP Global Services and our HP storage solution helped us save up to six hours each night on our backup and batch processing operations,” says the vice president of Management Information Systems at the firm. “As a result of our StorageWorks SAN and EVM, we now get a significant amount of additional productivity from our employees.”

System Performance

For more than 90 years, NewCo Life has provided quality life, health, and annuity products to policyholders. As the pace of business accelerated, it became more difficult to support the information requirements of the organization. For example, NewCo Life's nightly batch processing cycle began to take so long that it did not always complete before the start of the next business day. Productivity suffered. In one instance, employees were unable to log in to the system for up to three hours while waiting for a tape backup to complete.

The staff traced the bottleneck to the massive computational and data-storage requirements necessitated by running batch and backup operations each night. They reviewed SAN offerings from various vendors in the hopes of finding one solution that could solve several problems. They also spoke with customers who faced similar issues. StorageWorks and software technologies from HP received the highest recommendations.

Investing in the Best Equipment

NewCo Life invested in a highly scalable StorageWorks Modular Array 8000 (MA8000) system configured as a SAN with about 800GB of data (scalable to multiple terabytes) and HSG80 Fibre Channel controllers. The SAN supports many computing platforms, giving NewCo Life maximum flexibility for the types of information systems it deploys in the future. "Our HP StorageWorks system increased our comfort level in IT support," says the vice president.

Today, the SAN acts as a common storage pool for the HP ProLiant and IBM servers, all running the Microsoft Windows NT 4.0 Server network operating system. Members of the IT staff use EVM to execute a parallel backup strategy and StorageWorks Command Console to manage the SAN and allocate storage from a centralized workstation.

As a web-enabled application, EVM makes it easy to create, run, and manage automated storage-replication jobs and to link them with external jobs to achieve fully parallel processing operations. NewCo Life can run its batch-processing and backup jobs in parallel by using EVM to split a multi-member mirror and then mounting the new single member on a backup server. This method frees the production servers for crucial batch-processing tasks.

"Before implementing EVM, we were forced to wait for the backup to finish before we could start our batch cycle," an engineer explains. "Now, we are running the backup and the batch cycle simultaneously and, because of increased disk efficiency, our jobs are completed about 30% faster."

Planning for Productivity

NewCo Life uses its StorageWorks SAN to store and back up data from many applications, including PDMA LifePro, Pervasive Software Pervasive.SQL, and multiple proprietary insurance software packages. “The HP SAN markedly improved data-processing performance, especially for our LifePro and financial applications,” says an engineer. “Faster response means better customer service—a decisive competitive advantage.”

The StorageWorks SAN also resulted in increased user satisfaction. “Employee morale increased instantly once people could count on all applications being available when they arrived at work.”

Business results

- EVM offloads backup, saving time and increasing performance of batch servers.
- The StorageWorks SAN increases productivity by 600 to 800 person-hours monthly.
- The SAN provides a standardized and common storage pool for HP and IBM platforms, saving significant costs for proprietary storage solutions.

Components

- StorageWorks Modular Array 8000 (MA8000) system configured as a SAN
- Multiple ProLiant servers running Microsoft Windows NT 4.0 Server network operating system
- IBM servers running Microsoft Windows NT 4.0 Server network operating system
- StorageWorks Command Console
- Enterprise Volume Manager
- Management Appliance
- PDMA LifePro
- Pervasive Software Pervasive.SQL
- Multiple proprietary insurance applications

Learning Check

1. What solutions does HP offer that uses EVM?

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2. Using the case studies for this module, what business value did EVM add the respective companies?

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hp StorageWorks data replication manager configuration and failover/failback

module 4

Objectives

After completing this module, the student will be able to:

- Describe scripting for HP StorageWorks Data Replication Manager (DRM).
- Review a case study that uses Data Replication Manager in the solution.

Overview

The structure of this module is divided into two sections. The first section discusses using scripting to automate Data Replication Manager. The second section discusses sample case studies that describe the use of Data Replication Manager in an enterprise environment.

Scripting for DRM

Usually, to perform failover, failback, or a resumption of operations, an administrator must manually issue a complex series of Command Line Interpreter (CLI) commands to a controller. The use of scripts greatly reduces the need for an administrator to manually issue many of these commands. The administrator only needs to run a batch file to issue the appropriate CLI commands.

The use of scripts in a DRM environment simplifies procedures from the operator's perspective when performing failover, failback, and resumption of operation changes. Eliminating the delay between command entries shortens downtime. The use of scripts also ensures that the sequence of commands has been predetermined in a calm environment, rather than during a crisis, when mistakes are more common. The result is a failover and failback process that is timely, consistent, and efficient.

Although scripting may make procedures easier to perform, the operator must still be able to perform a failover, failback, or failsafe-mode transitions with CLI commands if the scripts encounter an abnormal condition that prevents their satisfactory completion.

Scripting requires the following components:

- DRM Scripting Kit
- Perl interpreter
- Command Scripter

DRM Scripting Kit

This virtual kit consists only of files and is downloaded from the HP storage website. The kit contains the batch files, Perl scripts, example files, and program files necessary for the scripts to perform failover, failback, and resumption of operation procedures.

Perl Interpreter

Perl is the interpreted programming language in which the scripts are written. The Perl interpreter translates and processes the scripts. Every Perl script must pass through the interpreter to execute.

Command Scripter

Command Scripter is application software that provides an interface to communicate the CLI commands generated by the Perl scripts to the HSG80 controllers by means of the Fibre Channel bus.

How the Scripts Work

Perl Scripts

The scripts are written in the Perl programming language and reside on the local hard drive of the host. For redundancy, the scripts should reside on a server on both the initiator and target sites.

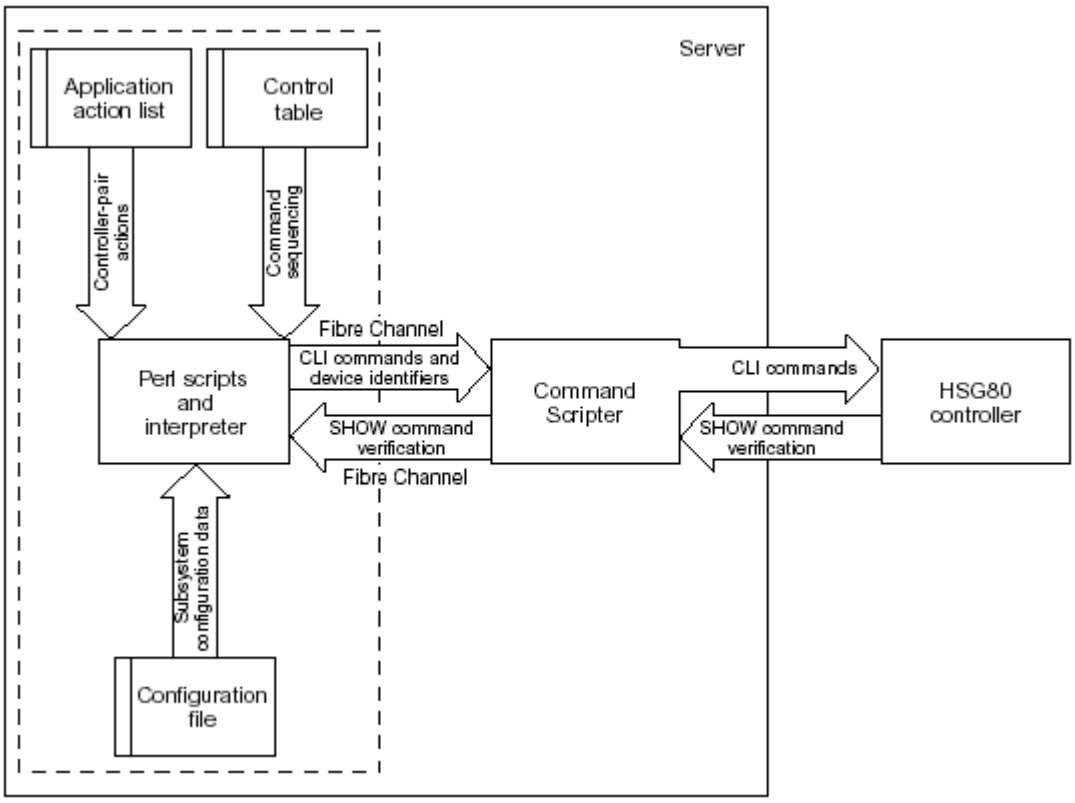
User-Customized Script Support Files

The failover, failback, and resumption of operation scripts use two user-customized file types to provide variable information: a configuration file and an application action list.

- The configuration file tells the failover/failback scripts what devices are attached to an HSG80 controller and how the controller is configured with respect to devices and storagesets. There is one configuration file for each HSG80 controller subsystem at the initiator and target sites.
- The application action list is used by the hsg_control.pl Perl script to perform failover, failback, and resumption of operation actions on the specified DRM initiator-target controller pairs.

The configuration files and the application action list are system specific. An administrator must tailor them to reflect unique configuration and failover, failback, and resumption of operation preferences. These files can then be used by the scripts to perform the necessary steps.

Running a Script



The user invokes a script by running a batch file from a command prompt on the system console.

1. The Perl interpreter processes the script based on the information in the configuration file and the application action list.
2. The script reads the control table, which defines the order of CLI commands to be issued and sends the appropriate sequence of CLI commands (for the controller configuration specified in the configuration file) to the Command Scripter.
3. The Command Scripter then communicates the commands to the HSG80 controller over the Fibre Channel bus and relays `SHOW` command verification back for the scripts.

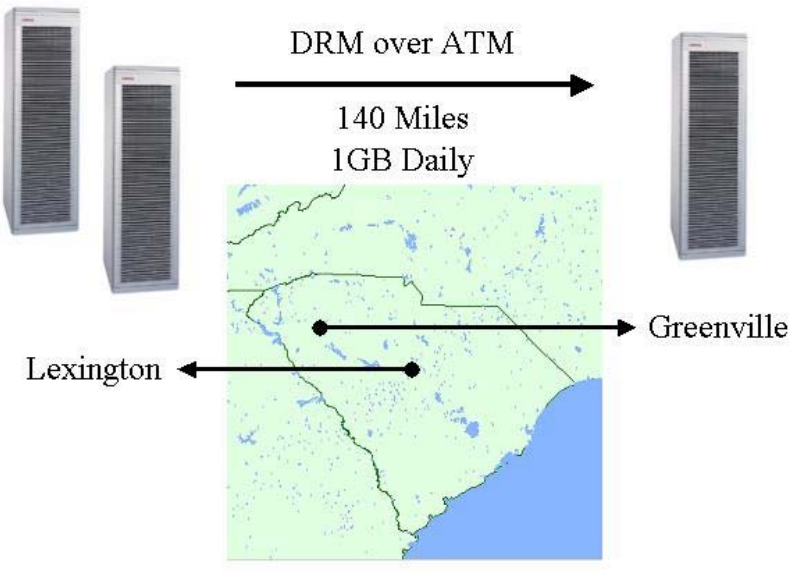
Customizing Files to a Configuration

A script that is run for each controller subsystem creates configuration files. It is not necessary to modify the configuration file of the initiator controller after it is created, unless the configuration changes.

The administrator must customize four sections in each target controller configuration file to allow the target controllers to assume the initiator role. The four sections are the association set, remote copy set, connections, and maximum cached read/write transfer sizes.

The administrator must also modify the application action list to identify those actions for controller pairs that the user wants to operate concurrently. For example, if four initiator controllers need to fail over during a short planned failover action, then the user would list the four target controllers in the application action list. All of the controllers will fail over together when that failover action is run.

Case Study — ABC Financial Group



Decision Factors

ABC Financial Group needs a solution to meet the following needs:

- Boost system performance
- Simplify backup and replication tasks
- Protect critical data assets
- Enabled disaster recovery for business continuance

Summary

The ABC Financial Group (a fictional company) strives to sustain a competitive advantage by leveraging technology, protecting data assets, and delivering an array of financial services. Eight months ago, the corporation began implementing a SAN in Lexington, SC, with a SAN-based disaster recovery center 140 miles away in its Greenville, SC, headquarters. Because The ABC Financial Group is situated on the southeastern U.S. coast, it is vulnerable to hurricanes and tropical storms. The company chose the Data Replication Manager (DRM) to heighten its data replication and data protection capabilities.

Storage Infrastructure that Pays Exceptional Dividends

The ABC Financial Group operates 108 branch offices in the Carolinas. Last year, The ABC Financial Group launched an Internet bank, www.ABCFGonline.com. Claiming $4.9 billion in total assets, the company also offers mortgage, brokerage, and investment services.

The executive vice president addresses the competitive forces in the financial services industry. “As new products and services alter the competitive landscape in our industry, we endeavor to deliver high-quality, cost-effective, technology-based financial solutions. Our products dictate strategic storage components. StorageWorks technology delivers fast, redundant images to our desktops, enabling prompt decision-making at the point of sale. This capability fosters a competitive advantage for our organization.”

At the heart of the company’s new data storage infrastructure is DRM software operating over an asynchronous transfer mode (ATM) network. “The HP solution is flexible and simplifies administration through cloning and snapshot replication,” says the V.P. “We replicate 1GB of data over ATM daily, so the solution fits our technical and business needs.”

ProLiant servers run the Microsoft Windows NT Server network operating system. Two Fibre Channel StorageWorks Enterprise Storage Array 12000 (ESA12000) systems, located at the Lexington facility, support business activities throughout the enterprise. Another StorageWorks ESA12000 system handles data replication and disaster recovery functions in Greenville.

“We tested DRM software by placing a sample database on the StorageWorks ESA12000 system in Lexington,” explains the V.P. “We replicated that database through Greenville, broke the connection and ran the application off the Greenville server. All the data was current and correct.”

Their data is crucial to their daily business, so the ABC Financial Group configured their DRM solution for normal error mode. A LUN was allocated for logging so that if the connection was broken, the company could continue business operations during a failure and then complete a mini-merge of the remote copy sets. The distance involved is also a barrier to running a complete normalization.

Cashing in on Administrative Savings

Today, about half of the company's critical business applications are connected to the SAN, which affords 3TB of storage capacity. Each day, the IT staff replicates about 6GB of new data, 1GB of that new data is replicated remotely.

Critical financial applications, such as an imaging system and a loan-decision application running on the Microsoft SQL Server database, underscore the need for optimal performance. For example, SAN-based storage makes it easy for The ABC Financial Group to send high-speed images of documents to branch locations.

"We can bring up images quickly and verify the information on a bank teller's screen, as opposed to finding and routing paper copies. This improves customer service," the V.P. notes.

As the organization's data requirements grew, it was difficult to back up the vast amount of data in the available backup window. The ABC Financial Group chose the Enterprise Backup Solution, which allows system engineers to move backup traffic from their TCP/IP network to the high-speed SAN fabric. The IT staff also relies on Enterprise Volume Manager software, which manages controller-based clone and snapshot operations, minimizing downtime during backup and data migration operations. As a result of these capabilities, the staff drastically improved its backup environment.

A StorageWorks TL895 Digital Linear Tape (DLT) library rounds out the SAN solution.

Storage in Reserve

The ABC Financial Group is currently in a growth mode, which is why computer system scalability is so vital.

"We anticipate that our bank imaging application will increase from 1TB to 2.5TB over the next year," the V.P. says. "StorageWorks ESA12000 systems will scale to meet our needs."

Having such a scalable infrastructure enables The ABC Financial Group to minimize new equipment purchases. The V.P. estimates that investment protection will save the organization at least $500,000 over the next two years.

Looking ahead, The ABC Financial Group plans to connect other key business applications to the SAN. The financial services company now enjoys centralized storage, including automated disaster recovery, superior backup procedures, improved employee productivity, and better customer service.

Business Results

- Protected data assets
- Enabled disaster recovery for business continuance
- Improved customer service with high-speed imaging
- Increased worker productivity and enabled more efficient IT management
- Fostered a clear path for future expansion

Components

- ProLiant 5500 and 6400 servers and two ProLiant 8500 servers run the Microsoft Windows NT Server network operating system and Microsoft SQL Server database.
- Three StorageWorks ESA12000 systems and a StorageWorks TL895 DLT Library support data storage functions.
- Data Replication Manager software, Secure Path software, Enterprise Volume Manager software, Enterprise Backup Solution software, HP Insight Manager management software, and StorageWorks Command Console storage configuration software provide data replication, backup, security, and simplified administration.
- HP Global Services assisted with design, configuration, and installation.

Learning Check

1. What components are required to use DRM scripting?

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2. Using the case studies for this module, what business value did DRM add the respective companies?

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Overview

The following module contains three case studies for class discussion. It is assumed that you are aware of our StorageWorks line of products. As a class, discuss each scenario, and then devise a solution that incorporates one or more pieces of HP storage software. The solution should include the StorageWorks and HP storage software products recommended for each solution. Cost is not an issue, but each solution should incorporate the existing infrastructure, as well as provide the best fit.

Case Study 1

Responsible for operations at 450 sites in 50 countries, the Information Technology Group (a fictional company) is deploying the Microsoft Exchange 2000 application to support more than 70,000 mailboxes. After a comprehensive evaluation, the Information Technology Group (ITG) selected StorageWorks systems and ProLiant servers as the platforms of choice.

"The dynamic scalability of ProLiant servers and StorageWorks storage systems makes them ideal for our Microsoft Exchange 2000 environment," says an engineer.

They need your help designing their SAN.

Like many large organizations, ITG is shifting from local, host-based storage to a controller-based SAN. Realizing that future performance, scalability, and capacity requirements can no longer be satisfied by locally attached storage arrays, ITG is using the Exchange 2000 deployment project as an opportunity to embrace the SAN paradigm, moving large Exchange servers to a SAN environment.

Managing this sophisticated Exchange project environment is a team of many different groups within ITG. Network traffic averages more than 4 million messages per day, with close to 1 million of them traveling to and from the Internet. Today, ITG counts more than 70,000 mailbox users in 50 countries running on Exchange 2000. Most of these users employ Microsoft Windows 2000 Professional and Microsoft Outlook 2002 software to access the Exchange environment.

ITG is looking to create a scalable, high-performance data storage infrastructure for its Large Mailbox implementations. The storage arrays would be attached to ProLiant 8500 servers running the Microsoft Windows NT Server network operating system. Each array must be configured for redundancy.

For smaller mailbox implementations, ITG deploys ProLiant ML570 and ProLiant DL380 servers.

The required backup operations and practices apply specifically to Large Mailbox configurations consisting of ProLiant 8500 servers managed at a central location. For smaller Exchange 2000 servers — those located in regional data centers and site data rooms (SDRs) — backup and restore operations are managed locally by the site support staff utilizing traditional methods.

Required Results

- Ensure reliable storage and backup for approximately 70,000 Microsoft Exchange 2000 mailboxes worldwide at 450 sites in 50 countries.
- Support dynamic scalability while creating a common pool of storage that can be allocated as needed.
- Ensure Exchange 2000 disaster recovery under the Microsoft Windows NT operating system while providing continuous operation and remote data protection.

List your solution components. Describe configuration and concepts involved.

Case Study 2

Development, Inc. (a fictional company) is a leading software company. They are currently reassessing their storage needs, and they would like you to help design a solution that meets their business needs.

Currently, all Windows 2000 servers have a locally attached DAT drive. Each night, server backups take about 8 hours. This is not a problem because all the backups can run concurrently. The operators frequently have to schedule a restore to recover files accidentally deleted by the developers. Sometimes developers have to wait until the following day for a deleted file to be restored before they can continue to work.

This company has a small staff of developers. The amount of storage they need changes from project to project. Currently, they are moving disks between the servers. They are also backing up images of the production data to test and run reports against offline. While there is adequate network and server performance, the restore time of production data is unacceptably long. There are also frequent requests for more storage space, and new network shares have to be created for the developers. The operations staff is overburdened with managing multiple servers, and they are desperate for a better solution.

Required Results

- Use as much of the existing equipment as possible.
- Allow centralized backups.
- Automate the process of creating multiple copies of production data to address testing by developers.

List your solution components. Describe configuration and concepts involved.

Case Study 3

Voyager, Inc. (a fictional company) owns and operates a profitable cruise line. They currently service 30 ports of call. Their reservation system is contained in an Oracle database on a single Sun Solaris server. The database is linked to their public website and to a proprietary reservation interface that is used by their employees. The database also has several business-to-business links to commercial airline carriers and licensed partners.

The Miami-based company has grown very quickly. Their database is growing quicker than they had anticipated. Even though they planned adequately for their operating systems and Oracle database, they did not plan for their increased storage demands.

Voyager, Inc. currently does not have a disaster recovery plan. They are very concerned about the lack of disaster tolerance planning because of the constant threat of hurricanes and flooding in Miami.

Because of international access to their reservation systems, the company cannot afford to have large backup windows. Their current windows are too long. They also would prefer to have minimal interruptions to users during normal system operations.

Required Results

- Use as much of the existing equipment as possible.
- Lower downtime due to backups.
- Upgrade to a NSPOF solution.

List your solution components. Describe configuration and concepts involved.

appendix A
learning check answers

Module 1 — Business Value of a Well-Planned Disaster Tolerance and Data Availability Plan

1. Define business continuity.

   24 x 365 access to virtually all IT-based business processes What is the business value of a properly designed and executed disaster tolerance/disaster recovery solution?

   Allows the organization to provide service and availability to their customers at an acceptable cost/risk. What are some of the factors that should be considered when developing a disaster tolerant environment?

   Transaction centricity, data centricity, recovery point, recovery time, a customer's priorities and needs What products do HP offer to help create a disaster tolerant environment?

   Virtual Replicator, Enterprise Volume Manager, Data Replication Manager, Secure Path

Module 2 — Using Virtual Replicator

1. What solutions does HP offer that uses the Virtual Replicator?

   Virtualized Storage Management for Microsoft Exchange 2000, Virtualized Storage Management for Microsoft SQL Server 2000

2. Using the case studies for this module, what business value did Virtual Replicator add the respective companies?

   The StorageWorks open architecture supports current and future storage requirements resulting in cost savings and investment protection.

   Virtual Replicator software eliminates seven hours of downtime during nightly backup operations, significantly increasing employee productivity, data accessibility, and customer service. The scalability of Virtual Replicator supports 20% annual growth rate.

Module 3 — Using Enterprise Volume Manager

1. What solutions does HP offer that uses EVM?

   Non-disruptive Backup Solutions, Rapid Restore Solution for SQL Server 2000, Oracle 9*i* Backup/Restore SolutionUsing the case studies for this module, what business value did EVM add the respective companies?

   EVM offloads backup, saving time and increasing performance of batch servers. The StorageWorks SAN increases productivity by 600 to 800 person-hours monthly. The SAN provides a standardized and common storage pool for HP and IBM platforms, saving significant costs for proprietary storage solutions.

Module 4 — Data Replication Manager Configuration and Failover/Failback

1. What components are required to use DRM scripting?

   Scripting requires the following components:

   - DRM Scripting Kit
   - Perl interpreter
   - Command Scripter

2. Using the case studies for this module, what business value did DRM add the respective companies?

   - Protected data assets
   - Enabled disaster recovery for business continuance
   - Improved customer service with high-speed imaging
   - Increased worker productivity and enabled more efficient IT management
   - Fostered a clear path for future expansion