

Rethinking business continuance

Driving data availability up and costs down

White paper

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Introduction

Virtually every business organization understands that successful operations depend on the continuous availability of its applications. Most companies rely on internal applications—ranging from enterprise resource planning to payroll systems—to keep the wheels of their enterprise turning. They also depend on external-facing applications for everything from selling products to their customers to automating the supply chain with suppliers and partners. The failure of any of these business-critical applications could be catastrophic to a company.

The causes of downtime are numerous. Top-of-mind causes include fire and natural disasters such as floods, tornadoes, and hurricanes. More unexpected are causes such as power system and cooling failures. But even more unexpected are the failures that don't count as true disasters: A fire in another part of the building can cause smoke and water damage in the best-protected data center. Human error can range from the wrong circuit breaker being thrown to an accidental discharge of fire-suppression material. When a failure occurs, its scope can range from a system to a rack, from a room to a floor, and from a building to an entire site.

A comprehensive business continuity solution includes not only the capacity to recover operations after a major disaster, but also the capacity to remain online during minor disruptions. Server virtualization software has brought great relief to IT organizations searching for high availability (HA) and disaster recovery (DR) solutions with a low cost of entry. Regrettably, the same organizations that choose server virtualization as part of their HA and DR strategy often overlook the requirement for a shared storage solution that adequately supports the HA and DR features their server virtualization solution offers. Fortunately, HP LeftHand P4000 SAN Solutions provide cost-effective support for server virtualization as well as integrated, no-cost HA and DR storage solutions that are arguably superior to those available at extra cost from other SAN vendors.

The need for an integrated HA and DR strategy

Effective business continuity strategies need to have both HA and DR components. But some organizations and vendors fail to differentiate between the two, believing that if they have one, they also have the other. In fact, HA and DR are two distinct components of a good strategy, and understanding the contribution that HA and DR both make can enable a more comprehensive business continuity strategy.

High availability helps to keep applications online and accessible in the event of a failure. HA is fast and automatic, and there is no loss of data in the event of a failure. Synchronous replication is the strategy most often used to implement HA in storage. Because of the high bandwidth and low latency required to replicate storage in real time, HA can be leveraged across a single data center, building, or campus.

Disaster recovery helps to recover operations when the primary site has failed completely and its HA mechanisms can no longer maintain application availability. Asynchronous replication is the storage strategy most often used to implement DR in storage. It makes and keeps copies of data at a remote site so that, in the event of a primary site failure, operations can be resumed at the remote location using a remote copy. Remote copy does not have the bandwidth and latency requirement of synchronous replication; it creates point-in-time copies of data that are not subject to distance limitations. The historical point in time to which an organization expects its operations to fail-over is known as its recovery-point objective (RPO), and the time it expects to take to perform the failover and resume operations is known as its recovery-time objective (RTO).

Table 1 summarizes the differences between HA and DR, and lists the HP LeftHand P4000 SAN Solutions discussed in this paper that are best suited to each.

Table 1. Organizations need to support business continuity objectives with a strategy that incorporates both high availability and disaster recovery.

	High availability	Disaster recovery
Purpose	Keep applications online and accessible in the event of a disaster	Recover when primary systems are no longer available; used as a last resort
Availability level	<ul style="list-style-type: none"> • Real time • Always accessible 	<ul style="list-style-type: none"> • Recover to a point in time—the recovery-point objective (RPO) • Meet a recovery-time objective (RTO)
Storage solution	<ul style="list-style-type: none"> • HP LeftHand P4000 SAN for single-site HA • HP LeftHand P4000 SAN for multi-site HA 	<ul style="list-style-type: none"> • HP LeftHand P4000 SAN in two or more production sites • HP LeftHand P4000 SAN with Remote Office Solution Pack for ROBO sites

Server virtualization and HA/DR

Server virtualization contributes to business continuity strategies in two ways. First, it changes the standard unit of server deployment from a dedicated server to a virtual machine (VM). This change makes it effortless to restart a VM on different physical hardware in a different location in the event of one or more host servers' failure. Second, based on this deployment model, virtualization software offers built-in features to assist with HA and DR:

- High availability in virtualized environments is supported by features that monitor server availability. In the event of a physical server failure, virtual machines running on the failed server are restarted on alternate servers.
- Disaster recovery for virtualized environments is supported by restarting virtual machines at a remote site in the event of a failure of the primary site. Sophisticated products such as VMware Site Recovery Manager (SRM) can coordinate the failover process, automatically executing predetermined steps in the right sequence for the failover to execute without problems.

HP LeftHand P4000 SANs and HA/DR

Server virtualization addresses business continuity planning, but it also places requirements on storage that are often overlooked. The high availability

functionality of server virtualization software demands the continuous availability of shared storage volumes. Disaster recovery functionality requires consistent, point-in-time remote copies and must be supported by VMware Site Recovery Manager.

A P4000 SAN is scale-out storage that supports both HA and DR with cost-effective solutions that are often superior to those offered by traditional scale-up SAN products:

- High availability is implemented with the combination of storage clustering and network RAID (nRAID). P4000 SANs have integrated, no-cost synchronous replication that supports both single-site and multi-site HA with a level of storage efficiency not available with most SANs.
- Disaster recovery is supported through asynchronous replication that maintains both time- and space-efficient remote copies at a disaster recovery site. Asynchronous replication using remote copy can be supported in a standard two-site configuration. It also can be supported between any number of remote offices and a central site, using a replication client that runs on remote sites and requires no additional hardware.

The issues that organizations need to consider when implementing HA and DR solutions in storage are detailed in the next two sections, along with the specific benefits that P4000 SANs bring to a comprehensive business continuity strategy.

Storage support for high availability

The goal of high availability is to maintain continuous application availability through real-time failover that doesn't require human interaction. While many SANs fall short in their ability to support this level of HA, P4000 SANs provide integrated, automatic HA features that support continuous availability across a wider array of failures than traditional SANs can handle.

Costly and complex HA with traditional SANs

The problem that most SANs have with supporting server virtualization HA is that they don't provide the required level of availability for the solution. When a physical server fails, virtual machines running on that server are restarted on an alternate one. Those virtual machines need access to the same logical volumes on shared storage that they were using before the failure. Making this happen can be both costly and complex.

Traditional SANs attempt to implement HA through redundant components that protect against single-component failures but not against multiple-component

failures, including the loss of a data center. They offer the option to purchase an additional storage system, add-on synchronous replication software, and the professional services to replicate data in a second location; but this option still does not support automatic failover because manual steps are required to point virtual machines to the alternate storage system in the event that the primary one fails. The result is that both failover and failback are manual, time-consuming, and risky activities that result in application downtime.

Straightforward, efficient built-in HA with P4000 SANs

P4000 SANs store logical volumes in a way that makes HA solutions low cost, low risk, and automatic. P4000 SANs don't replicate volumes; they replicate the data within each volume. The result is that the same logical volume is available before, during, and after a failure, with failover and failback both automatic and completely transparent to application servers. This availability makes P4000 SANs able to support virtualized environments not just through the failure of an entire array, but also through the loss of an entire data center. All of this is accomplished by configuring the SAN to be split between racks, rooms, floors, buildings, or sites.

Figure 1. Storage clustering creates a pool of storage resources and delivers them to application servers as logical volumes.

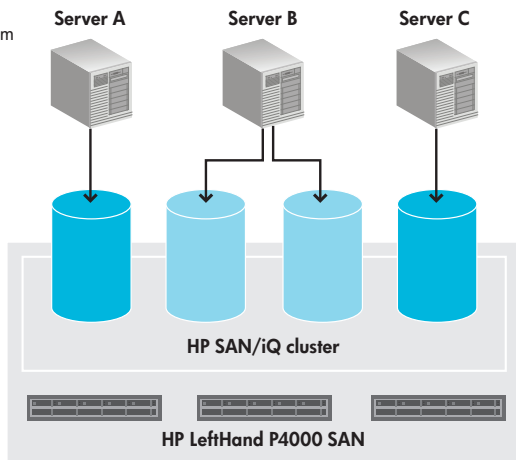
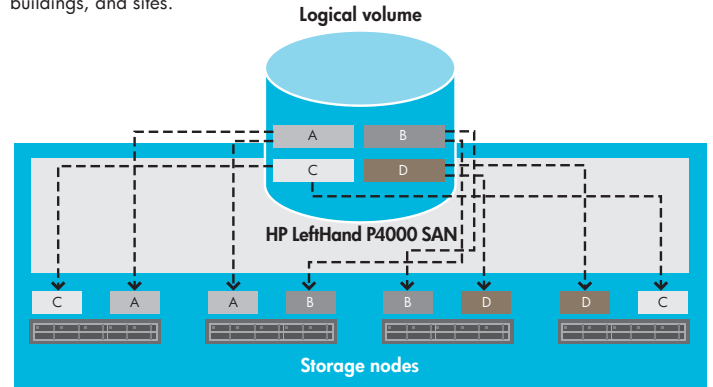


Figure 2. Network RAID provides built-in, transparent, remote replication between storage systems, racks, rooms, buildings, and sites.



HA with storage clustering and nRAID for VMware and other virtualized environments

P4000 SANs implement high availability using a combination of storage clustering and network RAID:

Storage clustering creates a scalable storage pool by aggregating the resources of a number of storage systems into a single storage pool (Figure 1). The pool accepts and responds to iSCSI requests as a single unit. All physical capacity and performance are aggregated and made available to the volumes created on the SAN. When more storage is needed, additional storage systems can be added to the pool, which seamlessly and non-disruptively reorganizes its storage to incorporate the new systems.

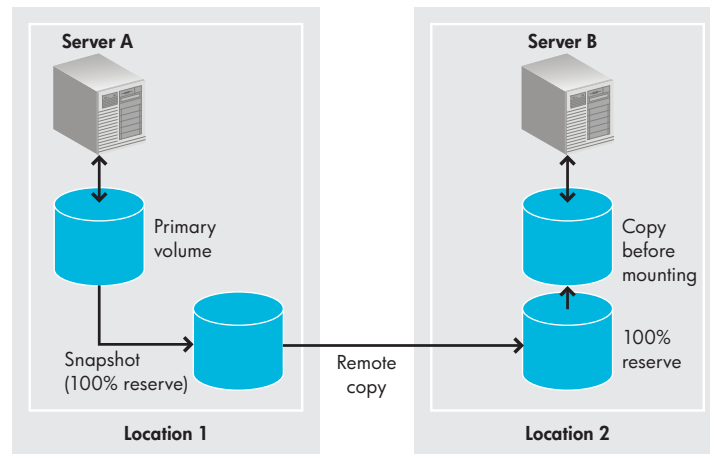
Network RAID (nRAID) synchronously replicates the blocks that make up a logical volume across one or more storage systems in the cluster (Figure 2) for high availability. An nRAID level of 2 causes every block that makes up a logical volume to be stored on two storage systems. With nRAID level 2 implemented, a single component, a storage system, or—in the case of a geographically split SAN—an entire location can fail, and each volume’s data will remain available. Failover and failback are automatic and transparent to application servers, because the pool itself keeps track of which storage blocks are up to date, and automatically updates outdated blocks when the failed part of the pool is restored.

Benefits of the P4000 SAN approach

High availability is an inherent characteristic of P4000 SANs, providing you with the following benefits:

- HA is cost-effective because synchronous replication is a no-cost option. You pay only for the HA you require because nRAID is configured on a per-volume basis. Avoid replicating volumes that don’t need to be replicated. Changing nRAID levels is non-disruptive.
- Storage ROI is increased because storage is used more efficiently: volumes can be thin provisioned, and volumes and their replicated blocks are stored in a single storage system, increasing efficiency by reducing fragmentation.
- Risk is reduced because failover and failback are automatic, with no human intervention required.
- P4000 SANs are recognized as one of the most popular HA storage solutions used for server virtualization.
- More failures can be tolerated with P4000 SANs, including component, storage system, rack, room, building, and site failures.

Figure 3. Traditional SANs require three copies of data when remote copies are created for disaster recovery purposes. This waste is compounded by the fact that remote copies are not thin provisioned.



Storage support for disaster recovery

Disaster recovery (DR) involves resuming operations using data that was current and consistent at a point in time in the past. There are two DR scenarios that most organizations need to consider:

- Business-critical enterprise applications, whether they are available to customers over the Internet or are for internal operations, need to continue to run in order for the business to be viable. These applications are typically configured to fail-over from a central location to a backup disaster recovery site.
- Applications and data at remote offices often distribute an organization's intelligence, and it is just as important for this data to be replicated at a central site and for remote-office applications to be able to fail-over to a central site for disaster recovery.

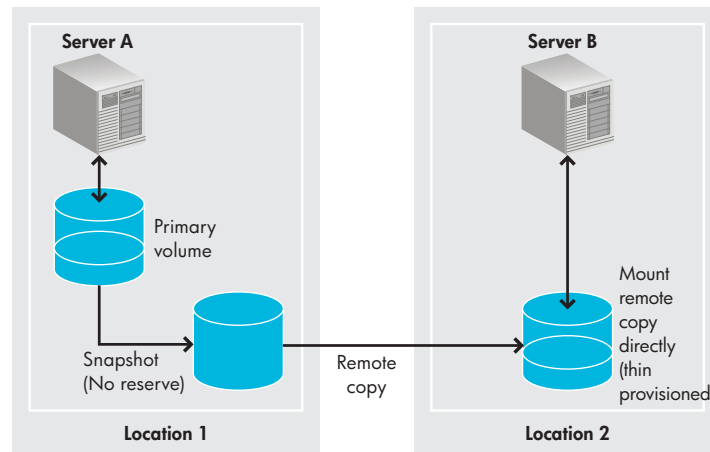
Excellent solutions are available to support the server side of disaster recovery—solutions that help to minimize recovery time, complexity, and risk. One such solution is VMware Site Recovery Manager (SRM), which stages and executes the process of failing-over to a remote site. The issue is whether the storage system supporting the failover is up to the task.

Costly and risky DR with traditional SANs

Implementing disaster recovery strategies with many SANs can increase storage cost and introduce unexpected risks:

- Inefficient use of storage raises cost. The add-on asynchronous replication software available with many SAN products requires multiple copies and full space reservation; this can cause reserves to amount to several times the actual storage requirement (Figure 3). Traditional SANs first require that a snapshot of the source volume be created with a 100 percent reserve. The remote copy requires a 100 percent reserve on the remote system. Then a third copy with 100 percent reserve must be created before a server at the remote location can mount the copy for use. If the volume is only half full, the remote copy requires not just the 50 GB that is actually required, but 300 GB—a six-fold increase in storage requirements!
- Inconsistent remote copies can result from traditional asynchronous replication software that updates remote copies a block at a time. This approach can result in inconsistent copies at the remote site, because the blocks representing a transaction or an update to a file system structure may not all be copied as a unit.
- Failover is complex and must be done correctly, affecting recovery-time objectives.
- Failback can be more complex than failover, because services at the remote site have to be shut down in an orderly fashion before remote volumes can be replicated back to the original site. Asynchronous replication software usually copies all of a volume's data blocks back to the primary site, further delaying time to repair.

Figure 4. P4000 SANs require only two copies of volume data when remote copies are made for disaster recovery purposes—a savings that is multiplied because remote copies and snapshots are thin provisioned.

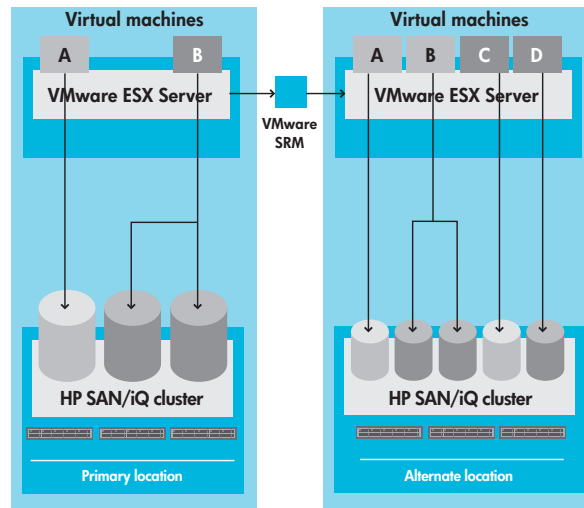


Time- and space-efficient remote replication for disaster recovery

P4000 SANs use a combination of thin provisioning and remote copies to make asynchronous replication for disaster recovery not just time- and space-efficient, but also nearly risk-free:

- Remote replication solutions using P4000 SANs require only two copies of a volume's data, one at the primary and one at the remote site (Figure 4). Moreover, a space-efficient snapshot of the volume's data requires no space reserve. Finally, the remote copy can be mounted at the remote site without creation of an additional copy. Not only do HP LeftHand P4000 SAN Solutions reduce the number of copies that are needed; they also reduce the size of each one: through thin provisioning, the local and remote copies use only the amount of storage actually allocated. Using the half-full 100 GB volume example, a traditional SAN requires 300 GB of storage, but the HP LeftHand SAN requires only 50 GB—a six-fold storage efficiency improvement.
- Both failover and failback are fast and accurate with P4000 SANs. Asynchronous replication is implemented as a series of scheduled remote copies. Each time a remote copy is executed, only the changed blocks are copied between sites. This has two significant benefits:
 - Speed is increased because only changed blocks are copied, which means that remote copies make efficient use of bandwidth between sites. It also means that failback is straightforward: rather than a complete copy of each volume at the primary site being required after a failure is resolved, only blocks changed since the failure need to be copied—dramatically shortening the time to resumption of normal business operations.
 - Risk is reduced because either each periodic remote copy is 100 percent complete or the changed blocks are not applied to the remote volume, so there is no concern regarding missing data blocks or blocks applied out of order.
- Business continuity can be enhanced further with HP Data Protector software, which works in conjunction with applications and P4000 SANs to create instant, consistent snapshots that can be used for remote copy. HP Data Protector provides a single solution for both physical and virtual environments, maintaining data integrity through zero-impact backups and instant recovery. With support for applications including Microsoft® Exchange Server, Microsoft SQL Server, and Oracle, HP Data Protector helps to simplify the recovery process by making every remote copy consistent from the application's point of view. HP Data Protector supports VMware Infrastructure software and provides advanced protection for VMware environments. Using a fully integrated VMware application agent, snapshot-based remote copies of virtual machines can be initiated or scheduled at any time and managed through the HP Data Protector user interface. With HP Data Protector, you can establish complex sets of RPOs and implement them consistently so that remote copies are ready to use for instant recovery in the event of a disaster.

Figure 5. HP LeftHand P4000 SANs work with VMware Site Recovery Manager to coordinate storage failover with virtual machine failover.



Reduced risk with automated failover and failback

Brokering a manual failover after a downtime event can be a daunting task. The smallest mistake can endanger business continuity, further lengthening downtime. P4000 SANs help to automate failover and failback processes, taking the guesswork and risk out of performing delicate business-critical procedures in times of emergency.

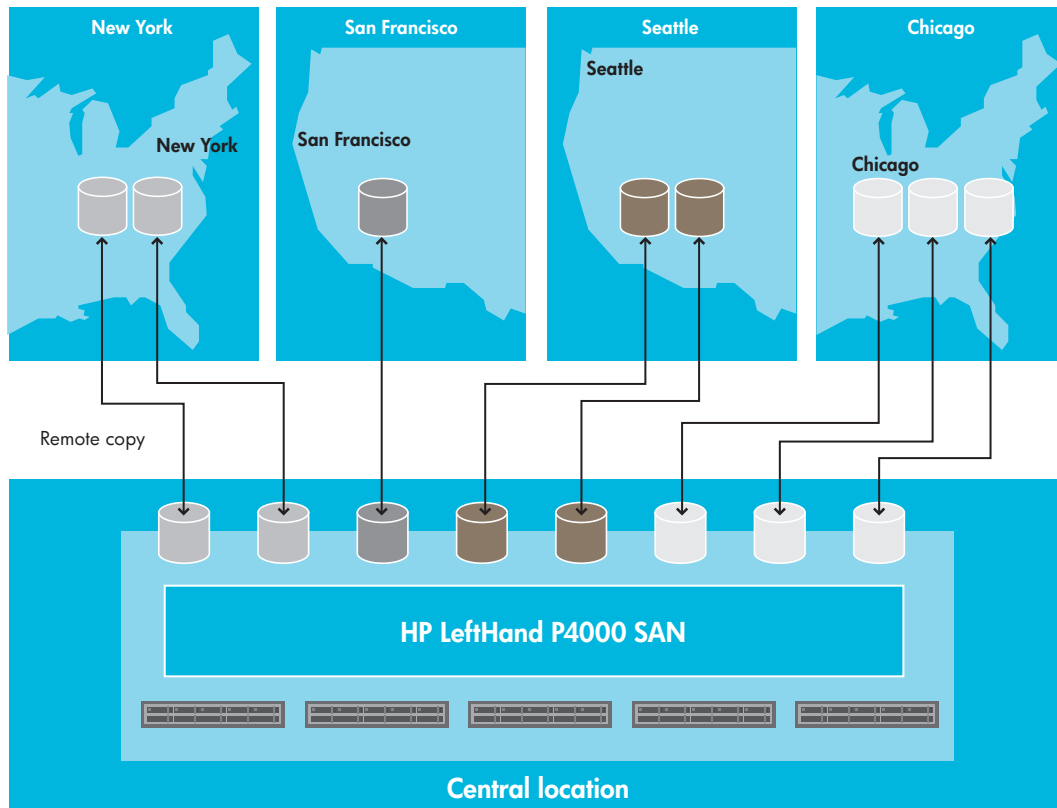
Failover/Failback wizard

HP SAN/iQ® Software's centralized management console (CMC) includes a failover/failback wizard that automates the process of promoting a remote copy to be the primary volume after a disaster strikes. It likewise automates the process of synchronizing data back to the primary site after the problem is resolved.

VMware Site Recovery Manager

For virtualized environments, P4000 SANs are integrated with VMware Site Recovery Manager (SRM). This VMware tool provides one-button failover that follows a customer-defined sequence of steps to bring up business-critical systems at an alternate location (Figure 5). The tool turns manual recovery runbooks into automated recovery plans with the ability to plan, test, and accurately fail-over business operations in the event of a disaster. It manages the correct sequencing of virtual machine restart in the alternate location, and it coordinates with the P4000 SAN to promote remote copies into primary volumes, simplifying and shortening recovery times. In addition to its integration with the P4000 SAN, VMware SRM also assists during failback, coordinating the movement of virtual machines with the synchronization of data back to the primary site.

Figure 6. HP SAN/iQ Remote Office Solution Pack helps remote offices maintain copies of their data at a central site for backup and disaster recovery purposes.



Disaster recovery strategies for distributed organizations

A best practice for companies with multiple remote offices or branch offices is to have one central site maintain copies of every site's data for disaster recovery use. HP SAN/iQ Remote Office Solution Pack is included with the virtualization SAN and multi-site SAN, and it puts a replication client to work in every remote office using existing server resources (Figure 6). This solution is cost-effective because it requires no SAN hardware at each site, and it is simple to manage: The replication clients are managed through the CMC.

Just like the solution for failover between two sites, the CMC's failover/failback wizard or VMware Site Recovery Manager can be used to coordinate the promotion of remote copies to primary volumes and to fail-over applications to the primary site.

HP Services

Put the strategic and technical know-how of HP Services experts to work for you:

When you buy HP LeftHand P4000 SAN Solutions, it's a good time to think about other levels of service and support you may need. You can trust the service professionals at HP to collaborate with you to make technology the difference in your business.

Recommended services

- **HP Support Plus 24 Service**—for around-the-clock, reactive onsite hardware support and over-the-phone software support
- **HP Installation and Startup for HP LeftHand P4000 SAN Solutions**—fast, reliable startup for enhanced server virtualization and business continuance with SAN solutions

Related services

- **HP Proactive 24 Service**—integrated proactive and reactive services for businesses looking to achieve better performance, higher availability, and greater stability
- **HP Proactive Select Service**—to improve IT performance and manageability for businesses looking for services flexible enough to cover the IT product lifecycle and adapt to changing needs

When technology works, business works. For more information, contact your HP sales representative or HP-authorized Channel Partner, or visit www.hp.com/hps/storage.

Conclusion

Many potential reasons for failure can cause business-critical applications to go offline and endanger a company's viability. While server virtualization has provided solutions that help with business continuance strategies, many traditional SANs do not provide effective support for the storage availability that server virtualization requires.

HP LeftHand P4000 SANs provide continuous storage availability across storage system, rack, and building failures, helping server virtualization software to effectively implement HA solutions that are automatic and dependable. The P4000 SAN's advantage is its simplicity and cost-effectiveness, making efficient use of storage while implementing a solution that requires no human intervention.

P4000 SANs provide accurate, consistent point-in-time remote copies for DR, which can be further enhanced through the use of HP Data Protector software. In the event of a disaster, these solutions are put into effect through the CMC's built-in failover/failback wizard or through tools such as VMware SRM. The P4000 SAN advantage is that remote copies are both time- and space-efficient. You purchase only the storage you need, rather than multiple times more just to meet unnecessary space reserves. Time-efficient remote copies help to reduce RTO and time to repair because only changed blocks need to be copied to create remote copies or to resynchronize the primary site after a failure is resolved.

When considering how different SAN implementations can affect your business continuity strategies, consider the HP LeftHand P4000 SANs advantage for supporting both high availability and disaster recovery.

HP Education Services for HP LeftHand P4000 SANs

A well-trained IT staff helps make your HP LeftHand P4000 SAN Solutions even simpler to use and brings still more agility—and greater value—to your business. Educated end users experience improved solution reliability, fewer support requests, speedier support issue resolution, and faster project implementation.

To help you get the most from your HP LeftHand P4000 SAN Solutions, HP offers two levels of P4000 SAN training:

- Basic training imparts the knowledge needed to understand, manage, and configure your P4000 SANs.
- Advanced training outlines best practices for P4000 SANs, based on field experience and applied industry knowledge.

Visit www.hp.com/learn/storage for more information.

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For more information

For more information about how HP LeftHand P4000 SAN Solutions can improve your business continuance capabilities, contact your HP representative or visit www.hp.com/go/p4000.

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