HP LeftHand P4000 SANs

Enabling a flexible, easy, and cost-effective storage strategy

Data is growing exponentially every day, technology is evolving, and budgets are shrinking—all of which place a huge strain on IT departments trying to determine the most effective storage strategy. They must accommodate change and growth, protect data, and meet the availability needs of today's business environment while striving to reduce storage management costs. Additionally, IT organizations are faced with implementing affordable offsite disaster recovery solutions, creating easily scaling storage for new projects, providing access to their information for a diverse range of users and applications, and re-allocating or provisioning storage quickly as business needs change.

All of these storage-related concerns are amplified in a virtual server environment. Flexibility is a key element of virtual environments, requiring the storage system to be adaptable as well as easy to manage. Legacy SAN arrays are extremely difficult to change or "re-provision" once they are set up—with provisioning often cited as the primary storage management pain point. This inflexibility offsets the hard-won benefits of a virtual server infrastructure.

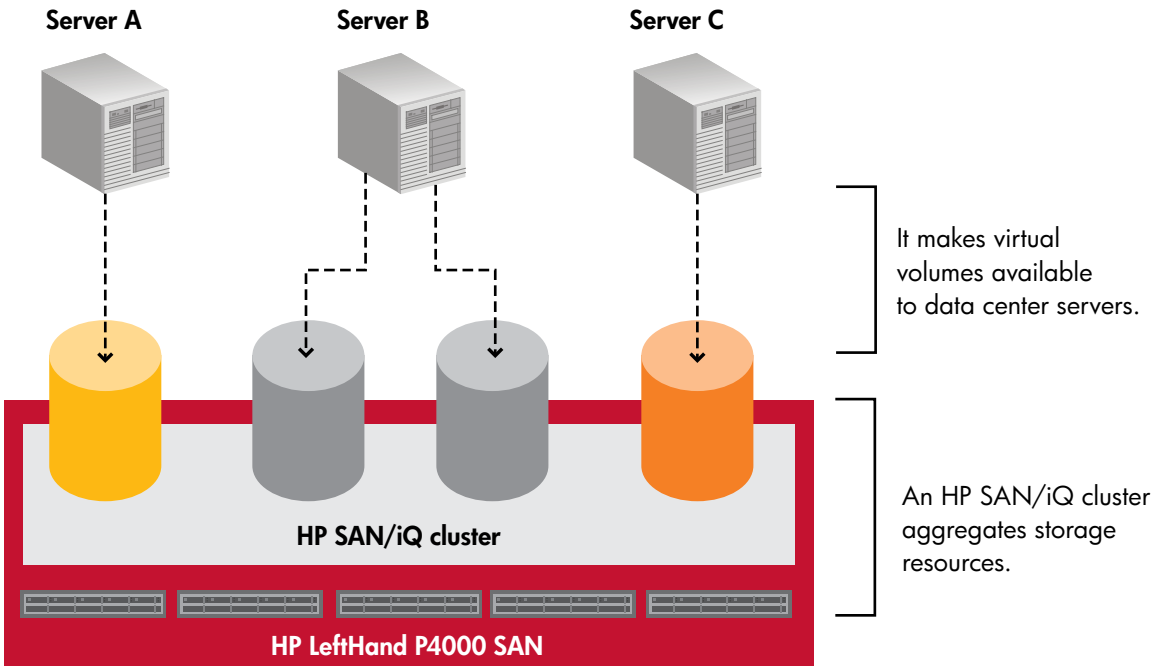
What is needed is a storage environment that is simple to learn, is easy to manage and change, scales up to any size without creating bottlenecks or downtime, and is highly available—all without costing an arm and a leg. The good news is that these requirements are met with every HP LeftHand SAN.

Solution overview

An HP LeftHand P4000 SAN has a different architecture from traditional SANs. Traditional SANs are composed of two separate hardware units—a controller for performance and disk shelves for capacity. Our systems combine the two units into what we call a storage system. A storage system is composed of an x86 processor, storage controller, disk drives, network ports, RAM, and cache—basically everything you need for a storage system in a single "building block." Then we add HP SAN/iQ® Software. HP SAN/iQ Software clusters multiple systems together into a single pool of storage. When you need to increase performance or capacity, you attach another storage system, which you can do with no disruption to your applications. Our ability to cluster provides some interesting advantages over traditional architectures.

1. **Cost and simplicity**. Buy only what you need today and grow your storage non-disruptively in the future. Most storage vendors make a lot of money by having you plan for growth and over-purchase today. With HP LeftHand SANs, you can start with a single system and scale to petabytes of data, all managed with an intuitive, single user interface.
2. **Scalable performance**. With HP LeftHand SANs, performance scales along with capacity. Because we are clustering all of the resources, not just capacity, the overall performance of the SAN increases each time a storage system is added; this helps you avoid expensive and complicated controller upgrades when bottlenecks occur.
3. **Availability**. Our biggest advantage is data availability. Our systems can sustain multiple system failures and still keep data online and accessible. Most storage vendors use dual controllers for high availability, but they don't protect against dual disk failures, power failures,

Figure 1. HP SAN/iQ Software storage clustering creates a pool of storage resources from a set of HP LeftHand P4000 SANs and delivers them in the form of virtual volumes to application servers.



air conditioning failures, or any type of "outside of the box" failure. Our systems provide levels of data availability beyond what dual controllers and hardware RAID can provide.

The other thing to note is that storage management features are included with every HP LeftHand SAN—and we don't charge extra for add-on software capabilities.

Storage clustering—scale your storage with ease

HP SAN/iQ Software storage clustering allows you to create pools of storage by consolidating storage nodes on the network into clusters. Storage clustering provides online scalability, both within a volume and across the entire storage pool. All available physical capacity is aggregated and available to the volumes created on the SAN.

In order to scale capacity and/or performance, simply add nodes to the storage cluster. HP SAN/iQ Software automatically redistributes the data for optimal data availability and performance. All the capacity, processing power, and bandwidth included in each node are aggregated into the entire SAN, helping to ensure an increase in performance as the SAN grows. To make the process even easier, HP LeftHand SANs let you expand volumes and add storage nodes online, without taking the volumes offline or causing application downtime.

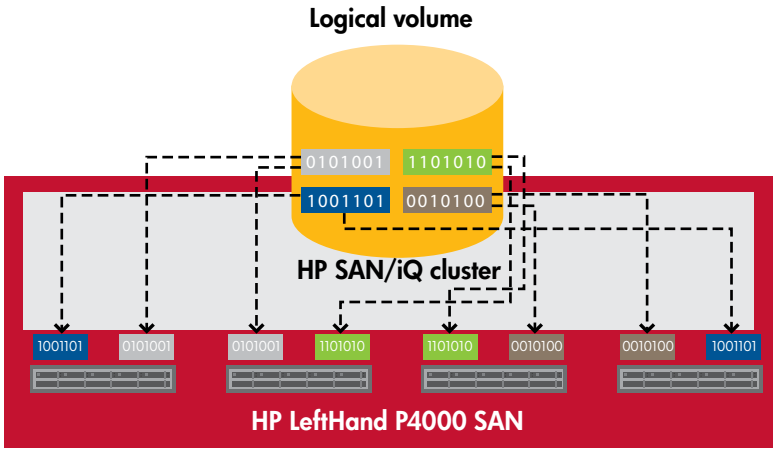
For increased access to hardware, customers can install storage nodes anywhere on the IP network. Within a facility, storage nodes in a cluster can be spread out between the server room and a network closet. A single cluster can also be spread across physical sites or data centers to eliminate the risk of data loss from a site or data center failure.

Customers can use HP SAN/iQ Software storage clustering to implement different tiers of storage in their SAN. For instance, a storage cluster of SAS-based storage nodes can be implemented for performance while a storage cluster of SATA-based storage nodes is implemented for higher density, all managed from a single interface.

Scalable performance

In a true cluster, every component contributes to performance. The cluster balances its own workload, distributing connections across all of the nodes. More nodes not only means more storage—it also means more network bandwidth, more RAID controllers, more cache, and more CPUs, all of which contribute to performance.

Figure 2. HP SAN/iQ Software network RAID stripes and replicates up to four copies of each data block across an HP SAN/iQ cluster. A logical volume's block replication with network RAID level 2 is illustrated.



Network RAID—delivering unprecedented availability

HP SAN/iQ Software network RAID (nRAID) stripes and mirrors multiple copies of data across a cluster of storage nodes, eliminating any single point of failure in the SAN. Applications have continuous data availability in the event of a power, network, disk, controller, or entire storage node failure.

SAN administrators can manage redundancy on a per-volume basis to optimize storage utilization and match the data protection of the volume to the application data on that volume. Customers choose one, two, three, or four copies of data across the storage nodes, allocating additional storage space only for data that warrants additional protection. For increased protection, nRAID can also be integrated into environments where application servers are clustered, enabling true, seamless, geo-cluster solutions that provide both application and storage clustering across geographies.

Built-in self-healing technology allows nRAID to proactively repair bad blocks on the SAN before applications encounter them. In addition, nRAID automatically optimizes the data layout of a volume over time, keeping performance optimal no matter how old or full the volume becomes.

Better than traditional SANs

Traditional SANs make you define RAID groups ahead of time by allocating the disks to a particular RAID group. Changing a volume's RAID level means taking its RAID group down for restriping or moving the volume to a different RAID group—either way, all the applications that depend on it suffer downtime during the move. Also, to support different RAID levels for different types of data, you must purchase and allocate physical disks for each, causing underutilization, creating storage islands, and forcing application downtime for copying. With HP SAN/iQ clusters, nRAID is an attribute of each logical volume, and you can change it on the fly—allowing you to closely match your storage characteristics to business requirements.

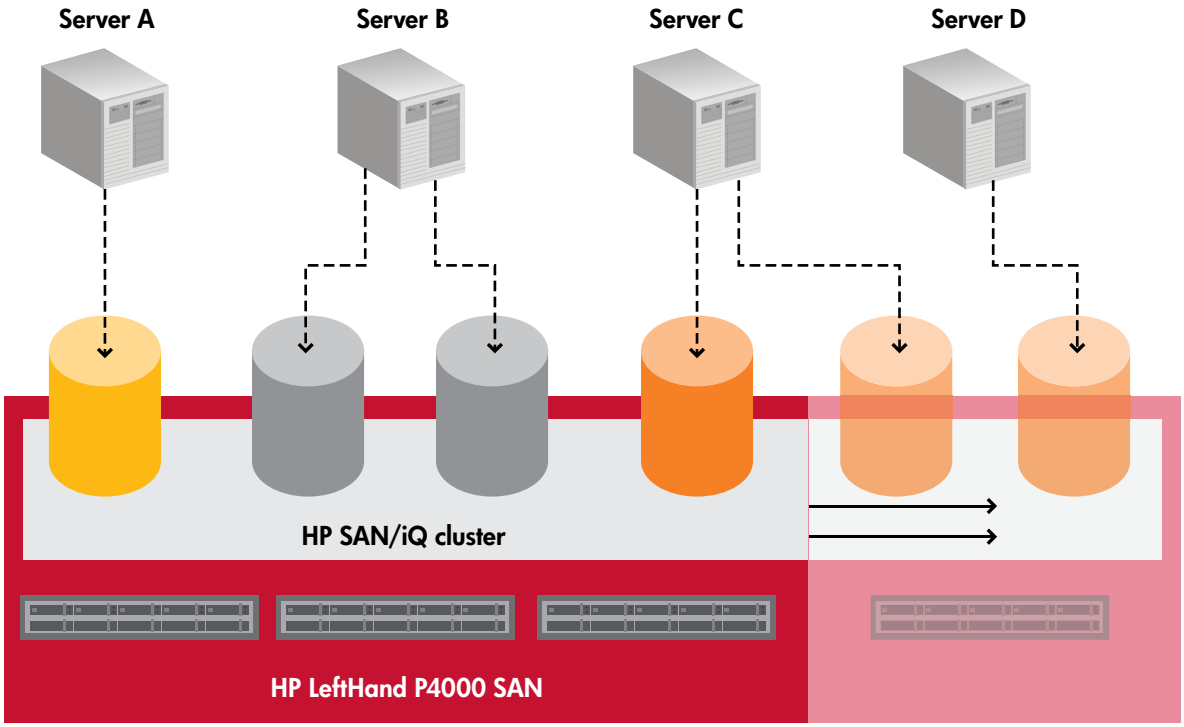
Better for business

The bottom line is that nRAID and synchronous replication help you better utilize your storage. Rather than having to maintain a different storage system for each storage policy, you can support multiple policies in a single HP SAN/iQ cluster. Because all of your storage is pooled, you reduce fragmentation and the wasted space that multiple, isolated storage systems bring. With the HP SAN/iQ grow-on-demand model, you can expand each cluster dynamically as you need the storage. When you add nodes to the cluster, nRAID re-stripes data and re-balances its workload internally, with no application downtime.

Thin provisioning—provision actual storage only as you need it

Most SAN vendors place the provisioning burden on SAN administrators, asking them to predict how much space will be needed for volumes, snapshots, and remote copies, and what the expected growth rate will be. That is because most storage provisioning models call for pre-allocation of storage space on the SAN. Worse yet, if you over-allocate storage, it is nearly impossible to reclaim that unused space.

Figure 3. HP SAN/iQ Software thin provisioning and non-disruptive scaling let you create larger volumes than you need today, and let them fill with blocks as your application data grows.



HP LeftHand SANs do not require pre-allocation of storage space. HP SAN/iQ Software manages all the storage allocations underneath a given volume, and the thin provisioning feature allocates space only as data is actually written to that volume. Thin provisioning lets you purchase only the storage needed today and then add more storage to the clusters as application data grows; this raises the overall utilization and efficiency of the SAN and ultimately increases the ROI associated with the SAN.

Give your volumes room to grow

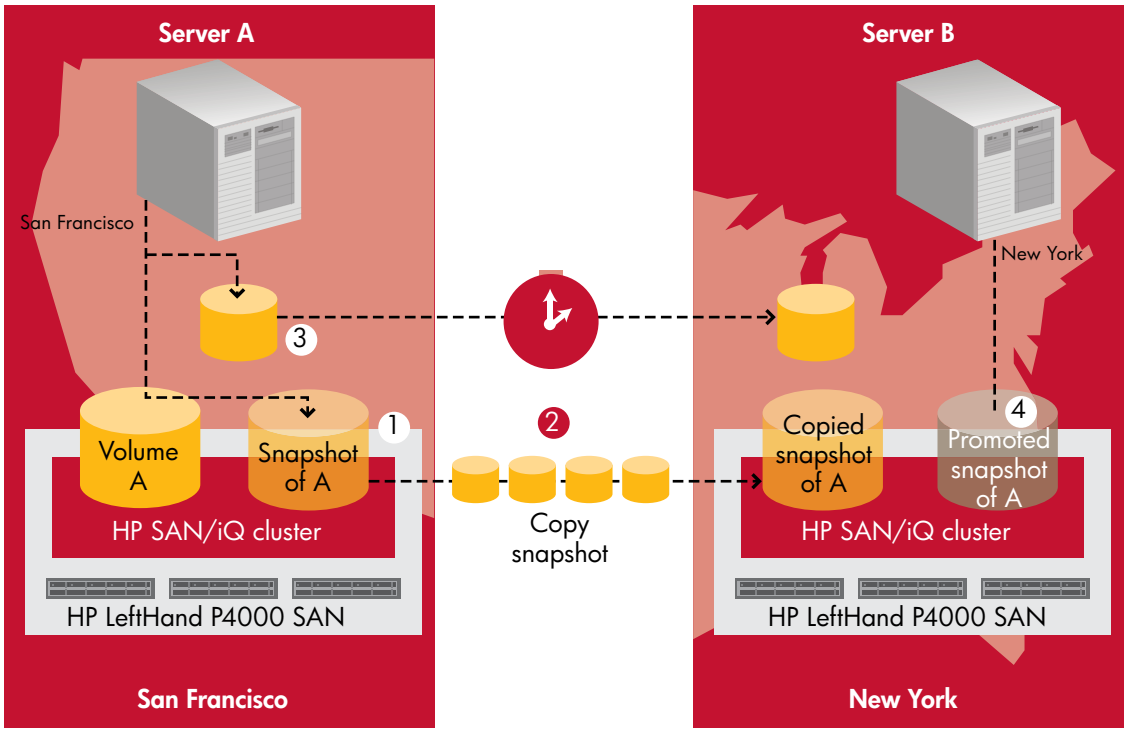
HP SAN/iQ Software's thin provisioning functionality lets you size your volumes with room to grow. You can create a volume with the size you expect it to be in the future, create a file system in it, and allow your application data to grow to fill the volume over time. HP SAN/iQ Software incorporates advanced monitoring and alerting mechanisms that make over-provisioning safe for day-to-day use. Thin provisioning is an attribute of each volume, so you can switch back and forth between thin and full provisioning as you wish—it's as easy as a click of the mouse. This enables greater flexibility, efficiency, and lower cost.

Snapshots—instant, point-in-time backups

Snapshots create instant point-in-time copies of data on a per-volume basis. Snapshots can be created in a variety of ways to meet business or application requirements. Administrators can create them manually ad hoc, on a scheduled or scripted basis, or via the Microsoft® VSS framework, and can then access these point-in-time snapshots to recover individual files or folders from the volume—or roll back an entire volume. Unlike most vendors' SANs that require a snapshot reserve, HP SAN/iQ Software creates snapshots that are always thin-provisioned for efficiency—consuming storage space on the SAN only for the data written to the snapshot, and eliminating any upfront space reservation or guesswork that could lead to snapshot and backup job failures. HP SAN/iQ Software snapshots open up a range of new possibilities for the IT organization:

- Virtually any backup software can access the snapshots, including products that update backup times in the volume itself.
- Snapshots can be mounted read/write, and you can change the snapshot without affecting the live volume.

Figure 4. HP SAN/iQ Software's remote copy functionality uses space-efficient snapshots to create consistent, point-in-time remote copies for backup and disaster recovery.



1. HP SAN/iQ Software creates a snapshot of the volume.
2. The snapshot is copied to the remote cluster either physically or via the network. Watermarks prevent confusion between local and remote volumes.
3. Asynchronous replication schedules send only the changed blocks to the remote site. Different retention policies enable you to save recent copies or a history of copies for recovery.
4. Remote volumes can be promoted for disaster recovery or simple backup.

- Use HP SAN/iQ Software snapshots as backups: retrieve a previous version of a file, or recover an entire volume instantly.

Remote copy—recover your data with minimal disruption

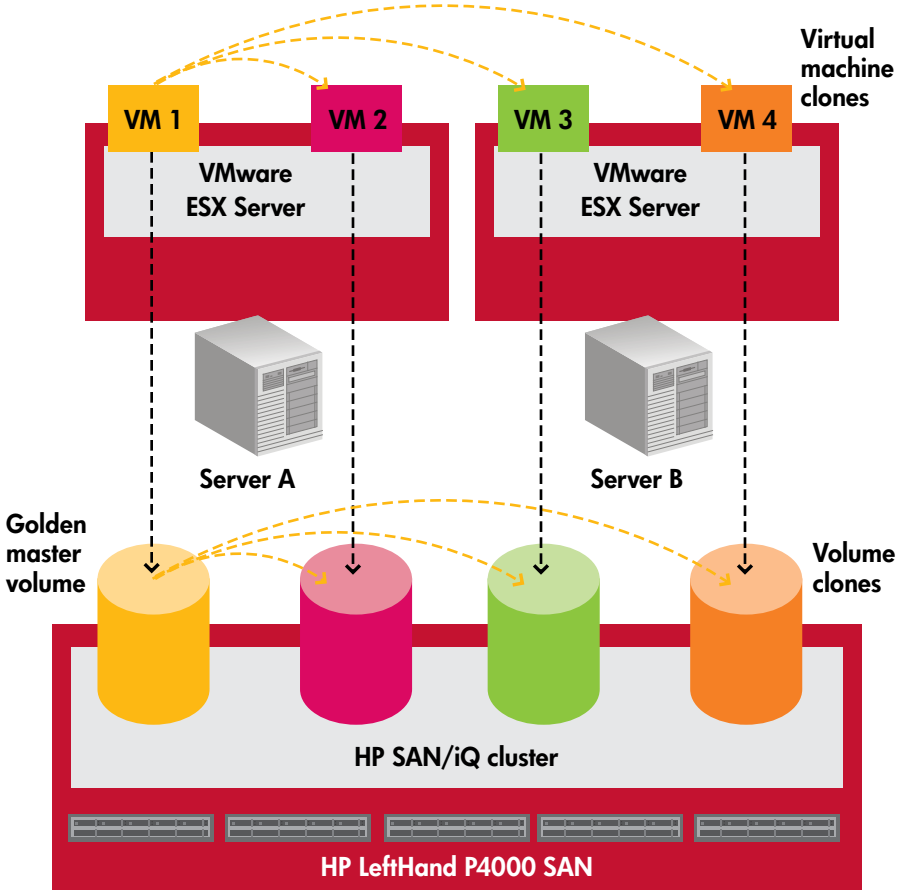
HP SAN/iQ Software's remote copy functionality lets you replicate thin-provisioned snapshots between primary and remote locations. Because the remote copies are thin-provisioned, no space reservation at the remote location is required. Remote copy is used for centralized backup and disaster recovery and can be set up on a per-volume basis. Placing your remote copies on a recurring schedule lets you achieve point-in-time asynchronous replication of the data between locations, sites, or data centers.

A failover/failback wizard is also included with remote copy for step-by-step, easy-to-execute disaster recovery procedures when needed most.

Asynchronous replication

Asynchronous replication is implemented as a series of scheduled remote copies. An HP SAN/iQ cluster understands the relationship of any given snapshot to the sync point, so all the HP SAN/iQ Software has to do to accomplish asynchronous replication is to copy the blocks that have changed since the last copy. Asynchronous replication is integrated with the HP SAN/iQ Software's snapshot mechanism, so you don't have to worry about write-ordering should a failure occur while a remote copy is in progress. Each remote copy is exactly the same as its source snapshot.

Figure 5. HP SAN/iQ Software with SmartClone Technology makes space-efficient volume copies instantly for use by virtual machines and physical servers.



Intelligent bandwidth management

You probably don't have infinite bandwidth between your sites, and HP SAN/iQ Software remote copy functionality helps you to intelligently manage and share your network resources so that you can support asynchronous replication while maintaining quality-of-service levels for the rest of your network traffic. The PrimeSync feature lets you physically move your initial volume copy to your remote location, which saves you from transferring potentially terabytes of data over the network. HP SAN/iQ Software also monitors and adapts to changing network conditions for bandwidth and latency, throttling the data transfer accordingly.

HP SmartClone Technology—instant, space-efficient volume clones

HP SmartClone™ Technology instantly replicates data volumes and data sets without requiring additional storage space. Each volume clone is a virtual copy that enables you to save time and space in a variety of environments and applications, including server and desktop provisioning, boot-from-SAN provisioning, and rapid copying of production data into test and development environments.

HP SAN/iQ Software with SmartClone Technology essentially breaks down the cost and technology barriers to using virtualization. For example, copies of existing virtual machines can be used to scale existing applications by adding identical server instances, to create virtual desktop systems based on "golden master" images, and to create test and development

environments based on existing production systems. Making new virtual server instances is easy, but most traditional SANs then require the time- and storage-space-consuming process of copying existing logical volumes for use by the new virtual machines. HP SAN/iQ Software with SmartClone Technology changes that, letting you make as many volume copies as you need—all in an instant, and with minimal use of storage. This is possible because:

- Volume clones are based on an original source volume so they are space-efficient and instantaneous
- Clones can be accessed from physical servers, virtual servers, and virtual desktops
- HP SAN/iQ Software with SmartClone Technology is de-duplication technology for server and desktop images—so there is only one copy of operating system files on the SAN, which helps raise storage utilization and increases the return on storage investments
- Cloned volumes are thin-provisioned, allocating only the storage you actually use, when you use it, increasing your storage ROI

Everyday SAN operations are simple and worry-free

The entire HP LeftHand SAN is managed from the HP SAN/iQ centralized management console (CMC). An administrator simply connects via the IP network to the storage nodes. Multiple data centers and sites of storage can be managed from a "single pane of glass" no matter where the nodes are physically located. The CMC also includes an integrated performance management system, providing you with detailed, real-time metrics and the ability to export statistics. All of the HP SAN/iQ Software features are managed from the CMC.

A single point of management

The HP SAN/iQ CMC lets you configure, manage, and monitor your SAN easily, making everyday operations simple and worry-free. Part of what makes managing HP LeftHand SANs simple is their superior architecture, which lets you scale storage, change a volume's RAID level, or migrate volumes between storage tiers without taking applications offline. Providing even greater ease of use is the CMC. It simplifies access to all SAN features on all of your HP LeftHand SANs, whether local or remote.

Now everyday administration is efficient and easy. When you need to change attributes of a volume, such as its network RAID level, its location, or whether it is thin or fully provisioned, the HP SAN/iQ CMC puts these management tasks just a click of the mouse away. When you need to do something more complex, such as failing back to an original volume after a failover to a remote site, wizards and tools take the guesswork out of operations where time and accuracy are critical.

Monitoring SAN performance is easy and intuitive

Quickly assess the performance of your SAN with the HP SAN/iQ Software's performance management system, which is also included with every HP LeftHand SAN. The performance management system is designed from the ground up to make it easy for you to obtain the performance metrics you need, when you need them. One click of the mouse, and the system's performance monitor is up and running in the CMC. Once running, the monitor lets you select from a short list of relevant statistics and counters to obtain performance metrics that are rolled up to the level of abstraction that you choose.

The HP SAN/iQ Software's performance monitor gives you specific performance information on each application server/virtual machine, logical volume, snapshot, storage cluster, and storage node, so there's no wading through irrelevant statistics in search of the ones you need. The performance monitor's graphical user interface is simple and elegant—not cluttered with counters and statistics that are irrelevant or difficult to understand. And each statistic includes a detailed explanation of what it means for SAN performance, integrated directly into the management interface.

Why HP LeftHand SANs?

HP LeftHand SANs provide the fundamentals of a proven storage solution, helping IT departments cope with today's influx of data in a way that's simple, flexible, and cost-effective. With HP SAN/iQ Software's virtualization capabilities built into every HP LeftHand SAN, you get a comprehensive enterprise-class storage feature set—including storage clustering, thin provisioning, remote copy, network RAID, snapshots, and SmartClone Technology—and simplified management capabilities.

Start confronting storage-related issues head-on with great ease, lower costs, and the flexibility that also allows you to take advantage of your virtual server environment's inherent benefits. HP SAN/iQ Software within every HP LeftHand SAN helps you create and maintain a truly effective storage strategy—one that accommodates change and grows seamlessly with your business.

HP Education Services for HP LeftHand SANs

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

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

- Basic Training imparts the knowledge you need to understand, manage, and configure your HP LeftHand SAN.
- Advanced Training outlines best practices for HP LeftHand SAN, based on field experience and applied industry knowledge.

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

HP Financial Services

HP Financial Services provides innovative financing and financial asset management programs to help customers cost-effectively acquire, manage, and ultimately retire their HP solutions. For more information on these services, please contact your HP representative or visit www.hp.com/go/hpfinancialservices.

HP Services

Put the strategic and technical know-how of HP Services experts to work for you: When you buy HP LeftHand 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 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**.

For more information

To learn more about HP SAN/iQ Software, which is embedded in every HP LeftHand SAN, visit www.hp.com/go/p4000.

Technology for better business outcomes

To learn more, visit www.hp.com

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