



LeftHand iSCSI SANs and VMware® Infrastructure 3

Virtualizing Servers and Storage Across the Enterprise

CLUSTERED OPEN iSCSI SANs



This white paper details how to implement a scalable, cost-effective IT infrastructure using VMware® technology and an iSCSI SAN powered by LeftHand's patented SAN/iQ software.

INTRODUCTION

Virtualization is a hot topic these days. The reason is simple—virtualization helps IT administrators get the most out of current storage and server resources, while minimizing the costs associated with future hardware acquisitions. It facilitates backup, provides broader disaster recovery options, and offers substantial business continuity benefits. Server and storage virtualization also ensures that enterprise infrastructures can scale easily to accommodate rapid business growth.

IT organizations that haven't yet taken advantage of virtualization are faced with a number of limitations related to running a single application and operating system per server, with direct-attached storage (DAS) locked into that one system. In very small organizations, resource islands of this type can be managed fairly easily. But as organizations grow in size, and particularly when growth is proceeding at a rapid pace, isolated servers and storage based on this legacy architecture become extremely expensive to manage and maintain. Hardware utilization is typically low and uneven, data migration is complicated, backup is frequently

spotty, and disaster recovery solutions, if they exist at all, are dangerously slow and unreliable.

Virtualization turns the tables by decoupling the software components of a computing environment from the physical hardware. An abstract layer is placed between the two, allowing administrators to handle applications, data or operating systems as independent files that can be easily and efficiently reassigned to physical servers and storage systems for improved hardware utilization and consolidation. Complex, rapidly expanding configurations become much more flexible when virtualized, and are therefore easier to manage, grow, and protect. Business benefits include improved application service levels, lower total cost of ownership (TCO), reduced business risk, and higher return on investment (ROI).

Methodologies for achieving virtualization can take many forms. LeftHand SAN/iQ, for example, leverages the iSCSI storage area network (SAN) model, creating virtual pools of storage that permit flexible distribution of data across multiple networked storage modules. VMware® Infrastructure 3 complements LeftHand SANs by focusing on application

servers. Each virtual machine has its own set of virtual hardware (e.g., RAM, CPU, NIC, etc.) upon which an operating system and applications are loaded. The operating system sees a consistent, normalized set of hardware regardless of the actual physical hardware components. Either solution alone ensures improved hardware consolidation and stronger business continuity guarantees. But together, SAN/iQ and VMware Infrastructure 3 provide a much more robust, well-protected infrastructure that scales easily, can be managed very effectively within budget, and can keep pace with growing demands on performance and availability. When evaluating virtualization solutions, it's important to select technologies that have a proven track record and offer a well-defined road map for future growth. Providers that have established strong industry partnerships and whose technology will be able to integrate with diverse enterprise hardware/software systems over time are especially desirable. LeftHand has been a member of VMware's Technology Alliance Partner Program since late 2004, allowing the technology partners to develop and support cost efficient, highly available solutions



for mutual customers. In addition, both LeftHand and VMware are members of the Technical Support Alliance Program (www.tsanet.org), an organization that facilitates seamless global collaboration between support organizations to best address mutual customer problems.

CHALLENGES OF SERVER/STORAGE SPRAWL

IT departments don't often have time to think ahead when responding to a sudden new business project or technology requirement. When a smaller enterprise expands quickly and sometimes unexpectedly, it might seem that the fastest and simplest way to keep up is to quickly tack on extra server and storage islands as needed. This usually means assigning one application to a server (to avoid application conflicts), linked with one DAS system. Storage systems are sometimes connected to servers over a network, but each typically remains dedicated to a single application. The result is a proliferation of costly, high-capacity machines

operating at diverse—frequently low—utilization rates, and presenting a number of serious limitations:

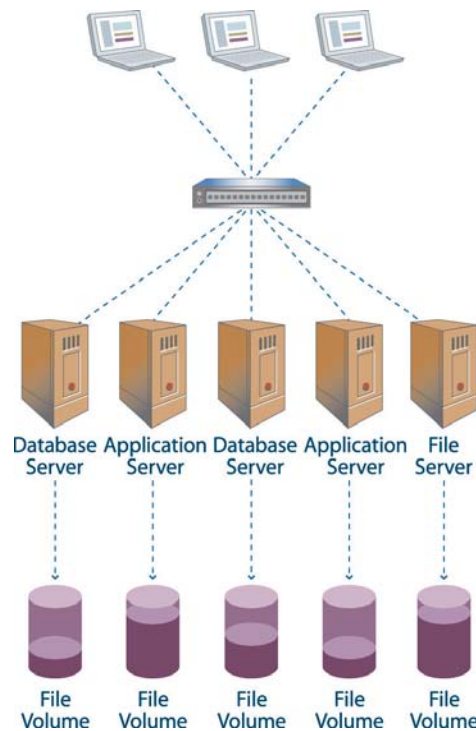


Figure A: Typical IT Environment—Direct Attached Storage. Conventional configurations make it impossible to balance loads among diverse servers, even when many are severely under-utilized. Systems are difficult to manage and vulnerable to failure. As more servers are added, more server/storage islands are created.

High cost

Under-utilization can send hardware costs through the roof, and also unnecessarily bloats expenditures for all associated hardware components and software. Administrators must purchase costly, high-end servers and storage in order to handle anticipated data volume over the long term, but these boxes will only use a fraction of their capacity for most of their lifetime.

Excessive administrative time is also required, not only to manage a large quantity of machines and related components, but also to continually monitor and respond to performance, capacity, availability and data protection issues.

Replication is a significant case in point: under DAS conditions, application configurations usually require identical hardware and software at both ends of a particular replication scheme in order to function properly. This puts a huge demand on IT budgets, and often implies that many business systems will have to make do with less effective backup methodologies.

Business at risk

Conventional DAS configurations don't lend themselves easily to enterprise wide disaster recovery schemes, which means that even a minor event could lead to a major disruption of business operations or cause a massive loss of critical business data. Even if all systems were eventually recovered, the time required to return to business as usual could result in significant missed revenues or a fatal downturn in credibility among partners and customers.

Server/storage sprawl also tends to generate a lot of unplanned and planned downtime. Backup and restore is always a sore point, often leading to gaps in service for restores and/or daily backup procedures. Guaranteed business continuity is almost always a logistical impossibility.

Complicated, time-consuming administration

Managing large numbers of individual servers and storage arrays takes up a lot of IT time. For example, if data needs to be migrated in order to balance loads and use storage capacity more efficiently, the process is long and complicated, and often requires system downtime. Backup



also requires excessive administrative time: since backup configurations must be identical to their respective production systems, the duplicate setup must be continually updated in lock-step fashion whenever a change of any sort is implemented.

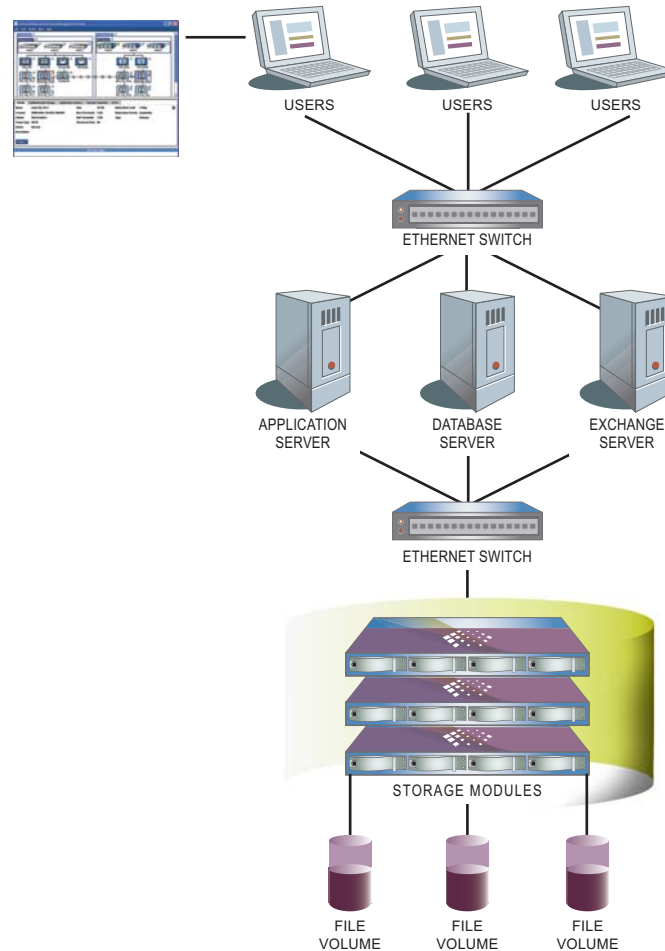
VIRTUALIZING STORAGE

LeftHand iSCSI SANs address the challenge of reducing inefficient, vulnerable DAS storage and simplifying storage management. Leading candidates for storage virtualization include:

- Storage with high uptime requirements
- Any storage environment maintaining a high volume of data
- Any DAS-reliant infrastructure with increasing demands for efficient business continuity solutions

LeftHand distributed storage clustering (grid storage) takes a "view many as one" approach that optimizes the benefits of low-cost, easily implemented iSCSI SANs. LeftHand SAN/iQ software pools the available storage from

multiple networked storage modules, permitting administrators to create new volumes out of this pool. The software then automatically distributes data efficiently across the physical storage systems. Volumes can be grown on the fly or reassigned whenever necessary, ensuring that physical storage capacity is always utilized effectively. As a result, more data can be stored on fewer storage arrays for maximum storage consolidation.



LeftHand SAN/iQ also offers several key features that significantly improve backup methodologies, minimize or eliminate gaps in service, and support reliable disaster recovery solutions:

- **Snapshots:** Regularly scheduled snapshots capture only changed data at backup time. LeftHand snapshot technology vastly reduces the quantity of stored data, but still permits full restoration of files whenever necessary.
- **Volume replication:** Flexible redundancy options permit synchronous data replication on a per-volume basis, ensuring continuous data availability.

Figure B: LeftHand SAN. SAN/iQ distributed virtualization leverages IP networking to pool standardized, modular storage arrays.



- Remote copy: Flexible, asynchronous operations minimize bandwidth requirements over an existing IP infrastructure. Remote copy capabilities—which are based on LeftHand snapshots—can be used to implement off-site backup schemes, business continuity guarantees, disaster recovery, split mirror configurations, data migration or simplified content distribution.
- Non-disruptive migration: Data volumes can be easily migrated between storage clusters without taking applications offline.
- No single point of failure: The distributed virtual architecture ensures a quick response to events affecting individual storage arrays, ensuring high availability and reliability.
- Simplified management: Multiple storage nodes are managed as a single entity, enabling quick and easy data allocation and migration. Replication and disaster recovery schemes are easier and less costly to implement. Most management tasks occur transparently, without affecting users, applications or critical business processes.
- High performance over the long term: The entire SAN infrastructure benefits from the aggregated performance features of all pooled resources, so when new capacity is added, performance actually improves SAN-wide.
- Improved ROI: Storage resources are utilized more efficiently, allowing more data to be stored on fewer physical storage systems. Acquisition costs and personnel time are lower, leading to overall reduction in total cost of ownership.

VIRTUALIZING SERVERS

VMware Infrastructure 3 directly addresses the challenge of optimizing hardware utilization and simplifying the management of an enterprise application infrastructure. Leading candidates for server virtualization include:

- Workloads with a small footprint, such as file servers, domain controllers, firewalls and Web applications
- Servers with high rates of reconfiguration, such as systems designated for development, testing, staging and proof of concept
- Workloads with high uptime requirements, such as messaging systems

To achieve its objective, VMware Infrastructure 3 applies a virtualization approach that allows a single physical machine to run multiple, heterogeneous, independent virtual machines. The average computer user tends to think of an operating system and its associated hardware

platform as unavoidably connected. But the VMware Infrastructure 3 virtualization technology allows users to load applications and their associated operating systems onto independent virtual machines (complete with virtual hardware), each of which is fully isolated from another. The virtual machines themselves are encapsulated into files that can reside on any VMware-compatible hardware platform. Multiple virtual machines can coexist on a single piece of hardware, regardless of the operating system and application running on each virtual machine.

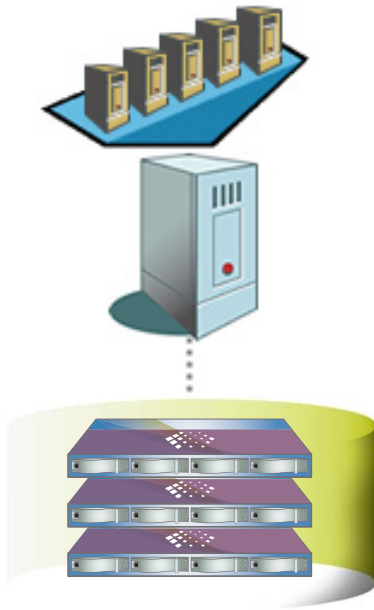


Figure C: Server Consolidation with Virtual Machines. Multiple applications can co-reside on the same physical hardware without conflicts. Heterogeneous applications and operating systems that previously required multiple servers can be handled on a single machine.

VMware Infrastructure 3 provides the ultimate in flexibility for server consolidation and capacity planning and reduces the need for additional servers over time. Management benefits include:

- Easy partitioning: Each virtual machine can be easily monitored, controlled and moved separately, without any impact on its virtual neighbors. Multiple virtual machines can run simultaneously on the same physical machine, all taking advantage of the performance features of the underlying hardware.
- Fault and security isolation: Since each virtual machine is independent of the others, any problems affecting one virtual machine won't "spill over" onto its neighbors.
- Easy virtual machine migration: Virtual machines can be added or moved from one physical server to another, without having to be powered off. This eliminates downtime in case the application needs more hardware capacity or if the hardware needs to undergo maintenance.
- Simplified redundancy: Since hardware and software are decoupled, replication no longer requires identical configurations at both ends. This makes replication easier, and also lowers the overall cost of data protection across the enterprise.
- Increased ROI: Applications can co-exist on a single machine, so administrators can handle more business processes using less hardware. Virtualization also keeps management time to a minimum, improving the scope of work that administrators can do within budget, and keeping the costs of server maintenance under control.

Read on to learn about the benefits of virtualizing servers and virtualizing storage in the same environment.



VIRTUAL MACHINES ON iSCSI SANs— THE BEST OF BOTH WORLDS

Organizations can gain even more ground by combining LeftHand SAN/iQ and VMware Infrastructure 3. The two solutions allow administrators to consolidate server and

storage resources for maximum efficiency, dramatically reducing enterprise-wide hardware and maintenance costs and streamlining infrastructure management. In addition, the benefits of virtualization are enhanced throughout the enterprise environment:

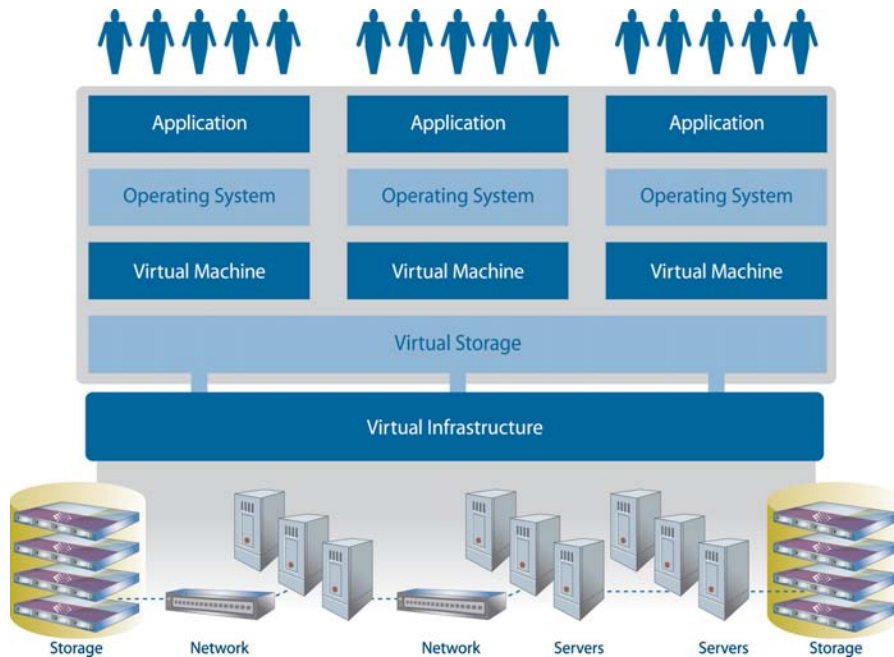


Figure D: Virtual Networked Infrastructure. A virtual infrastructure dynamically maps enterprise resources to business requirements. Result: decreased costs and increased efficiency and responsiveness.

Maximum scalability

Combining virtualized servers with virtualized storage on a LeftHand iSCSI SAN simplifies growth. Capacity planning is much easier and takes less time. New volumes can be created and added on the fly for increased control and flexibility in managing diverse server and storage resources. Plus, performance increases as the SAN expands, offering improved I/O times when new storage resources are added to the physical network.

Greater data protection, less business risk

The combination of virtualization solutions allows administrators to fully leverage the inherent backup, replication, and disaster recovery benefits of a distributed environment. For example, it provides multiple ways to avoid planned and unplanned downtime and ensure that minor glitches don't become major disruptive events. Furthermore, implementation costs are much lower, and servers and storage systems become easier to configure, alter, and maintain.

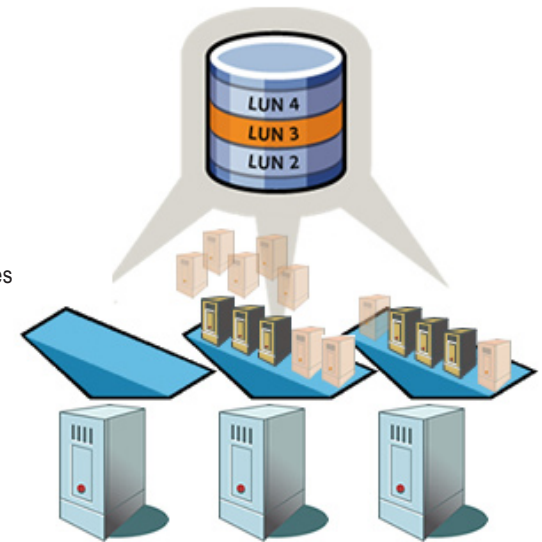


Figure E: Quick Recovery with Virtual Machines and Shared Storage on a LeftHand SAN. Virtual images live on the SAN. In the event of a physical server failure, a separate VMware server instance can be pointed to the appropriate logical unit (LUN) and started. Minimal downtime is required. Add data is protected and available through the SAN.



Improved utilization rates, lower hardware costs

Consolidation of application servers and storage systems with SAN/iQ and VMware Infrastructure 3 dramatically reduces hardware needs throughout the enterprise, significantly lowering acquisition costs and optimizing existing server and storage resources. Higher server/storage density also means fewer internal drives, less floor space and lower power consumption. Replication no longer requires complete system duplication, reducing hardware and software expenditures even further.

Ensured business continuity

Networked virtualized server and storage systems can eliminate the planned downtime previously required for backups and restores. Most administrative activities can occur in the background, without disrupting business operations. Efficient redundancy schemes and a combination of synchronous and asynchronous backup techniques provide the foundation for effective disaster recovery scenarios that fully protect enterprise systems in the event of a major failure. Availability and reliability are substantially higher, ensuring that servers and storage systems continue to provide service at optimum levels.

As mentioned above, users also gain from the fact that LeftHand has been a member of VMware's Technology Alliance Partner Program since late 2004 and that both companies are members of the Technical Support Alliance Program. Furthermore, customers in many industries have already successfully implemented a combination of SAN/iQ and VMware Infrastructure 3, establishing efficient virtualized server and storage environments based on these technologies.

SUMMARY

Virtualization in general offers a range of benefits to organizations that are at a crossroads in server/storage management and are actively seeking an efficient, affordable way to grow their enterprise infrastructures. In particular, LeftHand iSCSI SANS based on SAN/iQ and VMware Infrastructure 3 can lower costs, eliminate many common administrative headaches, ensure near-zero downtime, strongly control business risk, and scale easily for long-term enterprise growth. Special technology features found only in LeftHand or VMware solutions further enhance the combined environment, giving administrators many easy-to-use tools for simplifying critical day-to-day tasks. Strong support services and well-informed teams ensure that users can implement virtualization via SAN/iQ and VMware Infrastructure 3 easily, quickly, and effectively. A completely virtualized environment of this type can scale reliably to address future challenges and help organizations achieve evolving technology and business objectives.