nimblestorage

Engineered for Efficiency

Accelerate Applications, Protect Data, and
Empower IT with Nimble Storage

Storage plays a critical role in the virtual datacenter, responsible
for the performance of applications and the availability of data.
Storage is also undergoing a transformation with the use of solid
state drives and integrated data management functionality. This
paper demonstrates how Nimble Storage flash-optimized systems
are engineered to efficiently scale performance and capacity, keep
data protected and available, and make IT more productive and
empowered to take on new projects.

Executive Summary

Storage systems—and IT resources—are being strained by an increasingly virtualized, dynamic application environment, and ever-growing data sets and performance requirements. Flash solid-state disks (SSDs) help address some of these challenges when implemented in the right architecture. Nimble Storage has engineered such a solution from the ground up, leveraging its innovative technology, people, and partnerships.

Built on the Cache Accelerated Sequential Layout (CASL™) architecture, Nimble Storage's flash-optimized CS-Series arrays are the industry's most efficient storage systems.

Nimble Storage arrays:
- Accelerate the performance of all applications by using flash SSDs as cache to speed up reads and a write-optimized layout to speed writes by 100x over traditional storage.
- Optimize disk capacity through features that include: in-line, universal data compression of 30 to 75 percent with no added latency; redirect-on-write snapshots with no performance penalty; zero-copy cloning based on snapshots; and thin provisioning that allocates blocks of data on demand.
- Scale-to-fit application needs by scaling performance (compute or cache), capacity (disk storage), or both without disruption or forklift upgrades. For performance and capacity needs beyond a single system, scale-out by combining multiple arrays to create a pool of storage managed as a single entity.
- Protect data with integrated backups based on point-in-time, space-efficient snapshots. Customers can back up and restore data in minutes, protect more applications, maximize uptime, and improve Recovery Time Objectives (RTOs) and Recovery Point Objectives (RPOs) – without needing separate backup storage. Likewise, Nimble enables efficient data replication for simple and affordable disaster recovery.
- Empower IT by freeing up time and resources with Nimble Storage's lifecycle-based approach, which features all-inclusive pricing; push-button deployment; real-time, non-disruptive upgrades; live monitoring and analytics; and proactive support, including case generation and resolution.
- Nimble's partner ecosystem assures tight integration with virtualization and VDI solutions; core business applications such as Microsoft Exchange and SQL Server; and management tools such as vCenter.

Nimble Storage delivers more storage performance, capacity and functionality per rack unit than any other storage solution on the market. Nimble Storage customers routinely benefit from ten-fold improvements in application and VDI performance, dramatically simplified operations, greater usable capacity, and instant backups and restores for uninterrupted business operations.

The Need to Optimize Storage

In enterprises large and small, the IT environment is being reshaped by an increasingly virtualized, dynamic application environment and ever-growing data sets and performance requirements. As a result, storage systems—and IT resources—are being strained to deliver higher capacity and performance, protect more data and reduce operational overhead.

Virtualization and today's business applications place unique demands on network storage. As enterprises virtualize more applications and implement Virtual Desktop Infrastructure (VDI), these demands must be balanced with the diverse I/O and data protection needs of Microsoft Exchange, SQL Server, Oracle, and other business-critical applications. Flash solid-state disks (SSDs) help address some of these challenges.

Flash has excellent read and random I/O performance and low latency, which are crucial for business applications, server virtualization and VDI, for example. However, due to high cost and write endurance issues, using all-flash arrays is only practical for a very limited set of applications. Consequently, data storage vendors are promoting various combinations of flash and hard drives. Some vendors have taken a bolt-on approach, which simply layers flash on top of disk. This approach fails to leverage flash in a cost-effective way; nor does it maximize disk utilization. It does little to simplify IT's job as they now have to contend with managing multiple tiers of storage and data movement between those tiers.

What IT organizations of all sizes need is a flash-optimized network storage solution. Specifically, one that marries the best characteristics of flash and disk drives to accelerate both reads and writes, maximize disk capacity, protect data and applications, and simplify management. Storage that lets IT easily and affordably scale performance and capacity as their business needs change.

Nimble Storage has architected such a solution from the ground up, combining flash technology, high-capacity disks, and multi-core, multi-threaded computing to deliver the industry's most efficient and affordable storage systems. Nimble Storage's flash-optimized storage arrays accelerate applications, protect data, and empower IT to focus on new projects, such as VDI, while cutting overall storage costs as much as 50 percent.

Built on Solid Foundations

Since delivering its first product in 2010, Nimble Storage has become the fastest growing storage company in the industry's history, thanks to innovative technology, people, and partnerships. Nimble's team of industry veterans has a deep understanding of customers' storage needs and backup challenges, groundbreaking technical expertise, and a track record for successful companies.

Their focus on an affordable and efficient flash-optimized storage solution led to the development of the Cache Accelerated Sequential Layout architecture and the Nimble Storage CS-Series. This award-winning, high-performance solution combines primary and secondary storage on a single flash-disk array, eliminating the expense and inefficiency of maintaining multiple storage systems or tiers within a storage system. It also includes an integrated replication capability that streamlines offsite replication, which makes disaster recovery fast and affordable.

Nimble Storage's approach has attracted hundreds of customers across a spectrum of industries, including manufacturing, retail, financial, high tech and Internet, as well as the public sector. In addition, Nimble Storage's products and CASL architecture have garnered accolades from the Gartner Group, The Wall Street Journal, Dow Jones VentureWire, InfoWorld, Storage Newsletter, InfoStor, and others.

Nimble Storage's focus on building a strong partner ecosystem has also added to the company's momentum. With certification from leading vendors such as Microsoft, VMware, Citrix, and CommVault, customers are assured of tight integration with their existing virtualization and VDI solutions; core business applications such as Microsoft Exchange, SQL Server, SharePoint, and Oracle; and management tools, including VMware vCenter and vShpere, and Microsoft VSS.
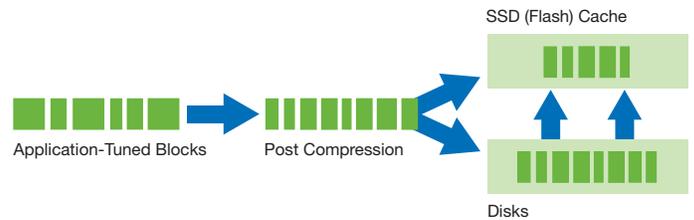

SSD (Flash) Cache

Application-Tuned Blocks   Post Compression

Disks

Figure 1. Data is compressed, cached, coalesced, and written to disk, resulting in exceptional random read and write performance.

Architected from the Ground Up

Among Nimble Storage's technology breakthroughs is its Cache Accelerated Sequential Layout (CASL) architecture. CASL is key to delivering high performance and capacity savings, integrated data protection that maximizes uptime, and easy lifecycle management. CASL features:

- Flash-based cache that accelerates read access to application data by caching active "hot" data in flash;
- Write-optimized data layout where data written by the host is first aggregated or coalesced in NVRAM, then is always written sequentially as full stripes to a pool of disk;
- In-line variable-length data compression of 30 to 75 percent with no added latency;
- Intelligent tracking of stored data, which enables instant caching of hot data to speed application performance and supports point-in-time snapshots and clones without copying data;
- Integrated backup based on point-in-time, space-efficient snapshots that can be taken at pre-configured intervals and potentially replicated to a secondary site, allowing for frequent recovery points with no performance impact;
- Flexible and non-disruptive scale-to-fit capabilities based on scaling compute and cache for higher performance, storage for capacity, or both without a forklift upgrade; and
- Integrated checksums, transparent data scrubbing and optimized dual parity (RAID-6) for ensuring reliability and availability of data.

Here is how Nimble Storage leverages the CASL architecture to accelerate applications, maximize storage capacity, protect data, and empower IT with the time and resources to invest in other areas.

Accelerate Applications

Historically, IT has had to decide up front whether to optimize their storage for application performance or to meet capacity needs cost-effectively. Each of these approaches are at odds with each other and often results in independent storage silos that are inefficiently utilized, difficult to scale, and create significant management overhead. With Nimble Storage, there's no trade off between high performance and capacity, and customers can scale both easily based on the workloads they're running.

High Performance: Nimble Storage boosts the performance of all applications, from Microsoft Exchange and SQL Server to VDI, by accelerating reads and writes. Using flash SSDs as cache, Nimble Storage accelerates reads by an order of magnitude over disks. A survey of Nimble Storage's installed base found that hosts on average enjoy sub-millisecond latencies for reads and writes. Because flash is integrated into Nimble Storage arrays rather than implemented as a tier, there is no RAID or data migration overhead.

Likewise, CASL enables substantially faster write performance than storage solutions using a write-optimized data layout. CASL aggregates, or coalesces, random writes into a stripe and writes them to disk sequentially. This eliminates disk latencies as the bottleneck in random writes to storage. Working with whole stripes also enables CASL to support a variable block length, including application-tuned block sizes on a per-volume basis. And CASL's efficient sweeping algorithm runs in the background without any performance impact maintaining consistent performance as the array is filled with more data.

"Performance is absolutely critical for us. The performance we're achieving with the Nimble Storage has proven game-changing for our development team. Today, code compilation takes a fraction of the time it once did, so idle time for developers has plummeted and productivity is at a new high."

Ethan Erchinger
Vice President of Operations
Plaxo

Efficient Capacity

Customers save significantly on disk capacity because Nimble Storage's CASL delivers more usable storage capacity compared to traditional storage architectures. Based on measurements of deployed systems, Nimble has found its installed base of storage systems has an average compression rate of 50 percent or 2x reduction in the storage footprint needed for all data.

Nimble uses a variety of mechanisms to optimize disk capacity, including in-line compression, snapshots, zero-copy cloning, and thin provisioning. The in-line compression capability reduces the data footprint by 30 to 75 percent, depending on the workload, without any performance impact.

CASL's intelligent indexing allows for space-efficient snapshots and zero-copy clones while maintaining data in its compressed form. Rather than copy entire data sets, CASL keeps an index of where data is stored and tracks the incremental changes. As a result, Nimble Storage's redirect-on-write snapshots consume one to two orders of magnitude less space than full copies and have no performance penalty.

Nimble Storage zero-copy clones use the snapshot architecture to create a new, cloned read/write volume, eliminating the lengthy process of copying data off of an active volume. Customers can create snapshots and clones in seconds and potentially save hundreds of gigabytes in disk capacity. Thin provisioning further maximizes storage capacity by allocating blocks of data on demand.

Flexible Scaling

The Nimble Storage "scale to fit" philosophy lets customer easily scale performance and capacity based on workloads or changing application needs. With Nimble Storage, customers can:

- *scale up performance* with more compute power (via an in-box upgrade to faster controllers) for greater throughput and IOPS and/or expand cache with larger SSDs;
- *scale storage capacity* by attaching external storage shelves; and
- s*cale out* both performance and capacity beyond the limits of a single system by combining multiple arrays into a scale-out storage cluster.

Protect Data

Administration of primary storage, separate backup, and separate disaster recover (DR) storage is complex and time consuming. In contrast, Nimble Storage's integrated data protection reduces the number of separate storage solutions need for primary and secondary data as well as backup, and greatly simplifies data replication for off-site disaster recovery, archiving and compliance. As a result, customers can backup and restore data in minutes, enabling IT to protect more applications, maximize uptime, and improve Recovery Time Objectives (RTOs) and Recovery Point Objectives (RPOs)—without needing separate backup storage.

Nimble Storage data protection features include:

Built-in Redundancy and Failover Capabilities

Nimble Storage arrays are designed for high availability with hot swappable active-standby controllers as well as redundant power supplies, cooling fans and drives. Nimble Storage's data layout enables an optimized implementation of RAID-6, which protects against dual-disk failure and avoids the performance penalty and disk re-build times seen with traditional implementations.

Instantaneous Snapshot-Based Backup and Restores

Snapshots are now an accepted backup method. Nimble Storage's highly efficient snapshot technology, coupled with CASL's redirect-on-write functionality and universal compression, ensure that snapshots consume minimal disk capacity. As a result, customers

> "[Nimble Storage's] compression has been remarkable — and especially on VDIs, where today we are seeing compression of between 60 and 80 percent. Now, we have literally four times the space and our expansion options are seemingly limitless."

Tony Banken
Network Administrator
Central Minnesota Jobs & Training
Services

can take frequent snapshots and store thousands of snapshots for months on a single system, enabling IT to retain and protect more data and improving RPO.

With Nimble Storage, Florida Blood Services now backs up its VMs hourly and as often as every 15 minutes, whereas only 10 percent of VMs could be backed up daily with the previous SAN solution. Nimble customer EU Services, a direct mail marketing company, cut its nightly backup window from 10+ hours to 10 seconds, a reduction of 99 percent.

And because snapshots are captured on the same array as primary storage without any data being copied, backup windows are a thing of the past. Snapshots can be taken in minutes and seconds and do not impact application or storage performance. Analysis of Nimble's installed base found that almost half of all the deployed arrays are configured to retain snapshots for more than one month.

With Nimble Storage, restoring data from locally kept snapshot backups is equally fast and easy, for low RTO. Nimble Storage customer EU Services, for example, recovered a SQL server database on their Nimble Storage array in less than five minutes; a task that would normally take hours. Similarly, Nimble Storage customer First Choice Health was able to restore 1.5TB of file data in less than 10 minutes, something that would have taken the entire afternoon with an external disk-to-disk or tape backup solution.

Nimble Storage also supports integration with CommVault SnapProtect allowing CommVault to leverage Nimble's native snapshot capabilities. This integration allows IT to leverage Simpana's rich data protection capabilities along with Nimble Storage's integrated snapshot capabilities.

Highly WAN-Efficient Replication
Nimble Storage replication is an order of magnitude more efficient and cost effective than traditional storage replication, speeding and simplifying disaster recovery. With Nimble's "thin" replication technology, compressed block-level changes are quickly copied to a remote array. Analysis of the Nimble Storage installed base found that half all of the workloads stored on the arrays are being replicated to a secondary system or site, compared to the industry average of 10 percent as reported by IDC.

Application/Virtualization Backup Integration
Through its partnerships, Nimble Storage provides application- and virtual machine-consistent backup and recovery for Microsoft and VMware environments, including backups of Microsoft Exchange, SQL Server, and SharePoint. Customers benefit from simplified backup and rapid virtual machine and application recovery.

Empower IT Staff

Traditional storage systems are time consuming to deploy and manage. Taking a lifecycle-based approach, Nimble Storage makes it easy to purchase, set up, upgrade, and support its storage systems. By reducing the cost and complexity of the overall storage environment, Nimble Storage frees up IT resources. Berkeley Research Group, for example, estimates that Nimble Storage arrays will save the company $500,000 in support costs alone over five years compared to their previous storage solution.

Nimble Storage empowers customers by providing:

All-Inclusive Solutions
Nimble Storage products are all inclusive, with no hidden costs. A single SKU includes all flash and disk as well as replication capabilities, application integration, and other software functionality. There is no need to purchase separate feature licenses, or host/guest agents.

"We can go wild with replication and snapshots because it costs us so little in terms of capacity. As a result, our RPOs have improved significantly."

Chris Fricke
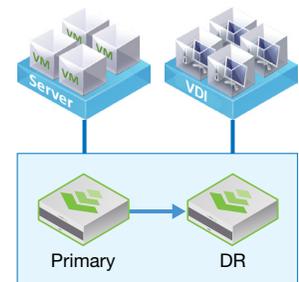IT Administrator
Clackamas County, Oregon

Figure 2. Nimble Storage simplified disaster recovery with efficient data replication from a primary to secondary or DR site.

"The Nimble GUI presents everything a storage administrator needs to manage an array, from current performance and throughput to compression ratios, event summaries and available disk space. I would feel comfortable handing the reins to someone who understands storage basics but has never administered storage and expect that, within 15 minutes, he could set up storage volumes independently."

Mike Brester
System Administrator
MulvannyG2

Push-Button Deployment and Operations

Nimble Storage streamlines storage provisioning with its intuitive user interface, auto-mated capabilities, and integration with leading hypervisor and application solutions. For example, application profiles automatically tune arrays for maximum performance and configure data protection policies for various workload types, eliminating the need for manual configuration. Likewise, thin provisioning automatically conserves disk capacity, while zero-copy cloning allows administrators to create clones of volumes in just three steps. For customers deploying virtual machines and virtual desktops, volume cloning can save hours of configuration and substantial storage capacity.

Proactive Wellness

Nimble Storage delivers unique proactive system health capabilities that increase uptime by helping customers address issues before they escalate. Nimble support tools and staff monitor information (heartbeats) from supported customer installations and provide real-time analysis of system health, including application and workload analysis, to spot and remedy potential issues. Customers receive alerts about critical system state, performance, error, and capacity issues, such as a misconfiguration. Nimble's support staff can also perform secure remote troubleshooting, configuration, and problem resolution; provide peer insights; and offer customized guidance.

Figure 3. Nimble Storage Proactive Wellness ensures optimal operations by actively monitoring and analyzing arrays and proactively creating and in most cases resolving support cases.

Application and Virtualization Integration

Nimble Storage makes it easy for customers to manage their storage infrastructure using tools they already know. With Nimble's vCenter plug-in, for example, IT administrators can use the VMware console to create data stores, set snapshot and replication sched-ules, review capacity and performance, create groups of clones in a single operation, and restore data from snapshots. Integration with VMware enables customers running vSphere to offload storage operations to Nimble Storage arrays, boosting vSphere's performance while optimizing CPU, memory, and storage resources.

Realtime, Non-Disruptive Upgrades

IT can deploy new Nimble Storage features and software releases with no downtime. When Kenneth Libeson at Meritage Group LP, an investment firm ran a Nimble Storage firmware update, he noted that it "could not have possibly gone smoother. One click to download, one click to update. I watched a live virtual machine during the eight-minute process, which never disconnected."

The Nimble Value Proposition

With its flash-optimized storage arrays and lifecycle-based management approach, Nimble Storage delivers more storage performance and capacity per rack unit than any other storage solution on the market. Nimble Storage customers routinely benefit from ten-fold improvements in application and VDI performance, low support costs, greater usable capacity, and instant backups for uninterrupted business operations.

Next Steps

Get started with a briefing to explore how Nimble Storage can help accelerate applications and improve efficiency, protect more data, and empower IT. For more information contact Nimble Storage at sales@nimblestorage.com or call 877-3NIMBLE (877-364-6253) or visit www.nimblestorage.com.
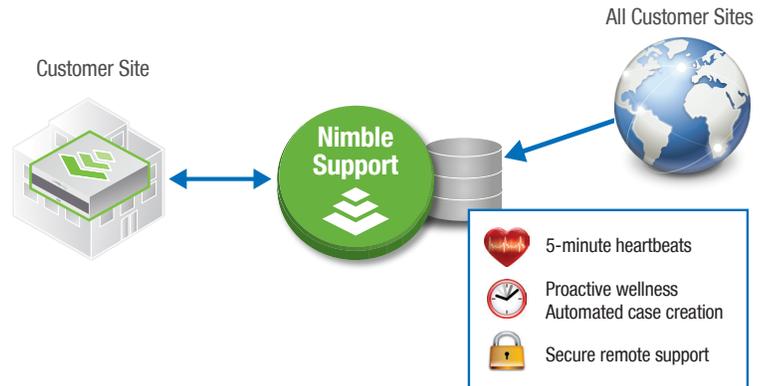
"With Nimble we have reduced power consumption, cooling needs and rack usage, eliminated traditional backup and associated backup windows, shortened our recovery point objective, improved server performance and improved perceived user experience, We now exclusively use Nimble in our data center for enterprise storage, and I have more time to tackle other business objectives."

Lucas Clara
Director of Information Technology
Foster Pepper

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