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## Nimble Storage Adaptive Flash

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# Nimble Storage Adaptive Flash

Nimble Storage’s Adaptive Flash platform enables enterprises to eliminate the tradeoff between flash performance and capacity, delivering the performance of all-flash arrays and the cost-efficient capacity of hybrid and legacy storage solutions, within a small datacenter footprint.

Adaptive Flash is based on two groundbreaking storage innovations: Nimble’s patented Cache-Accelerated Sequential Layout (CASL™) architecture, and InfoSight™, the company’s automated cloud-based management and support system.

This technology overview details how Adaptive Flash leverages CASL to accelerate read and write performance, optimize capacity, protect data and seamlessly scale to meet the changing demands of diverse enterprise workloads. And, how it relies on InfoSight’s powerful data sciences to guide scaling and ensure peak storage health.

## Write-Optimized Data Layout



**CASL is a CPU-driven storage architecture, so write performance is no longer dependent on spindle speed or spindle count. What’s more, CASL dramatically increases the useable capacity of disk and flash through compression and its unique sequential data layout.**

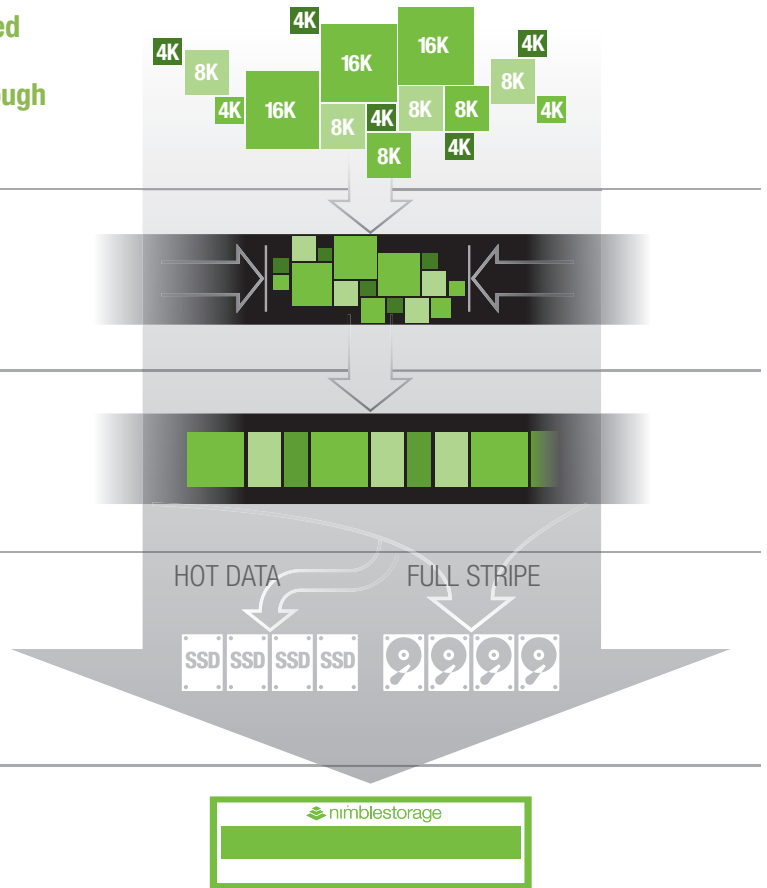
### In-Line Compression

CASL uses fast, in-line compression for variable application block sizes to decrease the footprint of inbound write data by as much as 75 percent.

Once there are enough variable-sized blocks to form a full write stripe, CASL writes the data to disk. If the data being written is active data, it is also copied to SSD cache for faster reads. Written data is protected with triple-parity RAID.

### Thin-Provisioning and Efficient Capacity Utilization

Capacity is only consumed as data is written. CASL efficiently reclaims free space on an ongoing basis, preserving write performance with higher levels of capacity utilization. This avoids fragmentation issues that hamper other architectures.



## Accelerated Write Performance

By sequentializing random write data, CASL’s writes to disk are orders of magnitude faster than other storage systems’ random writes. The CS700, Nimble’s top-of-the-line array, delivers double the write IOPS of a single MLC flash drive with a 7,200-RPM hard disk.



## Read Performance

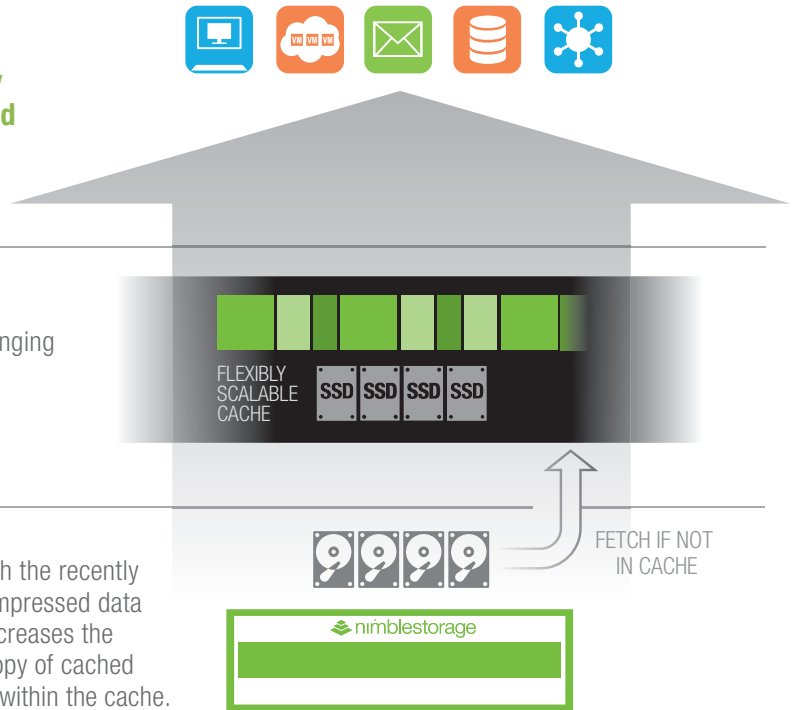
**CASL accelerates read performance by dynamically caching hot data in flash, delivering sub-millisecond read latency and high throughput across a wide variety of demanding enterprise applications.**

### Adaptive Flash

CASL leverages flash as a true read cache, as opposed to a bolt-on tier. This enables Nimble arrays to easily adapt to changing workloads. As the architectural foundation of Adaptive Flash, CASL allows flash to flexibly scale for higher performance, especially benefitting those applications that work best when their entire working sets reside in flash.

### Intelligent Caching

After a stripe is written to disk, CASL populates the cache with the recently written hot data, along with its associated metadata. Only compressed data in full erase stripes is written to cache, which substantially increases the endurance of the flash cells. And because the authoritative copy of cached data resides on disk, there is no overhead of parity or sparing within the cache.



## Efficient, Fully Integrated Data Protection

**All-inclusive snapshot-based data protection is built into the Adaptive Flash platform. Snapshots and production data reside on the same array, eliminating the inefficiencies inherent to running primary and backup storage silos. And, InfoSight ensures that customers' data protection strategies work as expected through intuitive dashboards and proactive notifications in case of potential issues.**

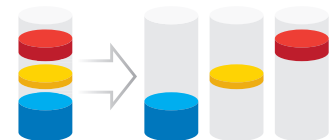
### Thin, Redirect-on-Write Snapshots

Nimble snapshots are point-in-time copies capturing just changed data, allowing three months of frequent snapshots to be easily stored on a single array.



### Instant Recovery

Snapshots reside on the same physical array as primary data for instantaneous data recovery.



### Efficient Replication

Only compressed, changed data blocks are sent over the network for simple and WAN-efficient disaster recovery.



### Zero-Copy Clones

Nimble's snapshots allow fully functioning copies, or clones of volumes, to be quickly created. Instant clones deliver the same performance and functionality as the source volume, an advantage for virtualization, VDI, and test/development workloads.



### Application-Consistent Snapshots

Nimble enables instant application/VM-consistent backups using VSS framework and VMware integration, using application templates with pre-tuned storage parameters.



## Simple and Seamless Scalability

By breaking the dependency of storage performance on spinning disk, Nimble Storage achieves a degree of flexible, independent scaling of both performance and capacity that allows customers to start with the most basic building block and precisely scale their Nimble infrastructure to support the changing demands of business-critical applications—without any downtime. Furthermore, InfoSight takes the guesswork out of scaling for the future, offering up highly accurate projections for capacity growth and expert recommendations on optimal cache and compute sizing.

### Capacity Scaling

Nimble Storage arrays can support as many as six expansion disk shelves, which can be added easily, and without disruption.



### Performance Scaling

Cache can be seamlessly expanded with higher density SSD drives or a Nimble All-Flash Shelf to sustain read performance. Array controllers can also be upgraded with more CPU cores, enhancing overall performance and throughput.

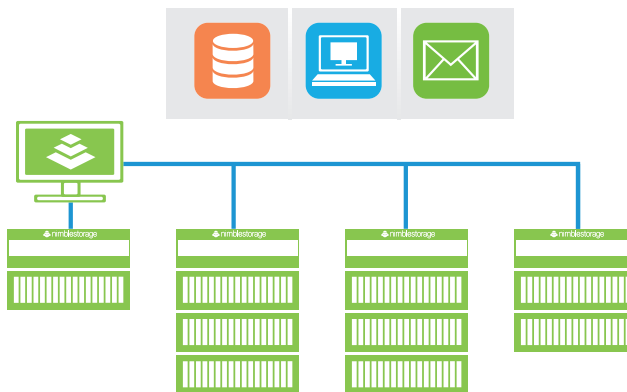


### Scale Out

Nimble Storage’s scale-out architecture allows performance and capacity to be seamlessly scaled beyond the physical limitations of a single array, to a storage cluster. This capability eliminates performance hotspots and capacity silos, consolidates array management, and protects storage investments.

Scale-out eliminates capacity silos and performance hotspots, and all storage resources can be managed as a single entity for better operational efficiency

Nimble Connection Manager (NCM) simplifies management through automating network connections from multiple hosts to volumes on the cluster



As many as four of any combination of Nimble CS-Series arrays can be clustered together, extending storage investments



Nimble’s scale-out architecture automates data migration to streamline the process of reconfiguring the cluster, avoiding disruption



Data is striped across nodes, enabling access to the collective hardware resources of pool member arrays



Data is automatically rebalanced across pool nodes, ensuring efficient capacity utilization

## InfoSight

**InfoSight is Nimble Storage's innovative approach to the storage lifecycle. Through the use of powerful data sciences, Nimble Storage completely transforms the reactive, error-prone support and management experience into a proactive process for maintaining peak storage health.**

InfoSight monitors all Nimble arrays, collectively and individually, from the cloud. It uses the tens of millions of sensor data points it gathers automatically per array each day and makes sense of them in real-time.

InfoSight consists of:



### The InfoSight Engine:

A data collection and analysis engine comprised of sophisticated analytics, system modeling capabilities, and predictive algorithms.

- **Performance correlation analytics** quickly identify leading factors contributing to performance or latency issues, eliminating what used to take up to several days of manual data collection and analysis.
- **Detailed systems modeling** helps identify performance bottlenecks, and indicates whether increasing cache or upgrading controllers would improve performance of deployed workloads.
- **Powerful, predictive algorithms** enable administrators to visualize organic data growth and identify when the array will approach capacity limits.



### The InfoSight Portal:

A secure online portal that serves as a window into the InfoSight Engine. It consolidates and presents complex storage health and performance information into an easy to understand, graphical format.

The portal presents a single view of all storage assets, along with detailed information about storage performance, capacity, volumes, snapshots and replication, user-defined alerts, and support cases.



### Proactive Wellness:

Proactive alerts for system health, performance, and protection gaps. InfoSight automatically opens 90% of all support cases and generates resolutions for over 80% of them.

## Application Integration for the Enterprise

**Adaptive Flash has been tested, verified, and certified with multiple enterprise applications and hypervisors. It integrates seamlessly into the stack, simplifying and accelerating storage deployment and management.**

- Predefined application-specific storage parameters, such as block size, caching, and compression, ensure optimal performance without exhaustive manual tuning.
- Seamless performance and capacity scaling allows virtualized infrastructure growth challenges to be easily met.
- Nimble Storage achieves higher VM-to-host consolidation ratios, delivering cost-effective virtualization deployment.
- VM-consistent backups using VSS framework and VMware integration, as well as Microsoft integration, simplify data protection.
- VMware Site Recovery Manager (SRM), leveraging full failover and failback support, enables high storage availability.



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