A comparison of hybrid storage arrays from enterprise storage providers

DCIG

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SMALL/MIDSIZE ENTERPRISE HYBRID STORAGE ARRAY BUYER'S GUIDE

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Table of Contents

1 **Introduction**
- 1 Hybrid Storage Array Distinctives
- 1 The Making of a Hybrid Storage Array
- 2 The Value This DCIG Buyer's Guide Creates for Buyers

3 **Executive Summary**
- 3 Why Hybrid, Why Now
- 3 Performance and Pricing
- 4 Conclusion

5 How to Use this Hybrid Storage Array Buyer's Guide

6 Disclosures

6 Hybrid Storage Array Inclusion and Exclusion Criteria

7 The 8-Step Process Used to Score and Rank Hybrid Storage Arrays

8 DCIG Comments and Thoughts
- 8 The Business Value of a Hybrid Storage Array
- 8 How a Hybrid Storage Array Differs From a Traditional Array
- 8 Automated Tiering / Caching Capabilities
- 8 Automated Performance Tuning and Monitoring
- 9 Virtualization Integration
- 9 Included Software
- 9 Old School versus New School
- 9 Performance and Pricing

10 DCIG Observations & Recommendations
- 10 *Best-in-Class* Ranking
- 10 *Excellent* Ranking
- 11 *Good* Ranking
- 11 *Basic* Ranking

12 **Small/Midsize Enterprise Hybrid Storage Array Scores and Rankings**
- 13 Overall Scores and Rankings

14 **Small/Midsize Enterprise Hybrid Storage Array Products**
- 15 AMI StorTrends 3500i
- 16 Dell EqualLogic PS4210XS
- 17 Dell EqualLogic PS6210XS
- 18 Dell Storage SC4020
- 19 Hitachi Data Systems HUS 110
- 20 HP StoreVirtual 4335 Hybrid Storage
- 21 iXsystems TrueNAS Z20
- 22 NexGen N5-200 Hybrid Flash Array
- 23 NexGen N5-300 Hybrid Flash Array
- 24 NexGen N5-500 Hybrid Flash Array
- 25 NexGen N5-1000 Hybrid Flash Array
- 26 Nimble Storage CS215
- 27 Nimble Storage CS300
- 28 Nimble Storage CS500
- 29 Tegile T3100
- 30 Tegile T3200
- 31 Tegile T3300
- 32 Tegile T3400
- 33 X-IO Technologies ISE 710 G3 Hybrid Storage Array
- 34 X-IO Technologies ISE 720 G3 Hybrid Storage Array
- 35 X-IO Technologies ISE 730 G3 Hybrid Storage Array
- 36 X-IO Technologies ISE 740 G3 Hybrid Storage Array

37 **Product Rankings Dashboard**

Appendices

A-1 Appendix A—Definitions, Explanations and Terminology

B-1 Appendix B—Vendor Contact Information

C-1 Appendix C—Author Contact Information

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2015-16 SMALL/MIDSIZE ENTERPRISE HYBRID STORAGE ARRAY BUYER'S GUIDE

A comparison of hybrid storage arrays from enterprise storage providers

Introduction

While hybrid storage arrays are still relatively new to the data storage market, their growing appeal is clear by the number of products now available to the prospective storage purchaser. *This DCIG 2015-16 Small/Midsize Enterprise (SME) Hybrid Storage Array Buyer's Guide* only includes arrays that have a maximum capacity of less than 500 TB. Even so, DCIG was able to identify 22 arrays from nine (9) different enterprise storage vendors that fit this SME criterion.

This Buyer's Guide is an update to the *DCIG 2014 Hybrid Storage Array Buyers Guide* that was published in November 2013. Since the publication of 2014 edition, nearly every vendor has come out with new models, warranting a Buyer's Guide refresh of this topic in what has become a dynamic marketplace.

Hybrid Storage Array Distinctives

Setting hybrid storage arrays apart from traditional arrays is their ability to dynamically place data in a storage pool that combines flash memory and HDD storage (and in some cases NVRAM and/or DRAM) resources in a flash-first or flash-optimized architecture.

This dynamic data placement may involve sophisticated caching of data and/or actual movement of data from one performance tier to another. Either way, the goal is to service nearly all application I/O activity with as little delay as possible. Although vendors use various terms to describe this "secret sauce" functionality, this Buyer's Guide refers to it as automated storage tiering (AST).

By intelligently and dynamically matching data with the most fitting storage media, hybrid storage arrays are designed to provide optimal performance and capacity; without the time-consuming, after-the-fact, manual performance tuning associated with traditional arrays.

The Making of a Hybrid Storage Array

Beyond the AST "secret sauce" that sets them apart from traditional arrays, hybrid storage arrays are characterized by up-to-date hardware which includes:

- Multi-core Intel CPUs
- Large DRAM caches (may be deduplicated and/or compressed further increasing capacity)
- Flash memory (low-latency storage, high IOPS), with some arrays using separate write-optimized and read-optimized flash memory pools
- Multi-terabyte HDDs (high capacity, low cost storage)

While automated storage tiering distinguishes hybrid storage arrays from traditional arrays; hybrid storage arrays are distinguished from one another by their features, which are summarized on standardized one-page data sheets under the headings of software, hardware, management, virtualization and support.

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Introduction (continued)

The Value This DCIG Buyer's Guide Creates for Buyers

Like all prior DCIG Buyer's Guides, this *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* does the heavy lifting for organizations as they look to purchase a hybrid storage array by:

- Delineating and normalizing hybrid storage array features, whether or not they are supported and where appropriate how they are implemented
- Weighting these features according to what end users consider most important
- Scoring these features
- Ranking each model
- Creating a standardized one-page data sheet for each model

The end result is that the *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* drives time and cost out of the product selection process by enabling prospective buyers to do *"at-a-glance"* comparisons between many different arrays. By identifying a short list of products that meet their specific needs, prospective purchasers can focus their product evaluation energies on those selected arrays and move more quickly to the competitive bid process.

Note that this Buyer's Guide is not intended to be a substitute for bringing individual models in-house for testing. That function should still be done, if possible, since every array will perform differently under different application workloads and data center environments. We hope you find that this Buyer's Guide meets its intended purpose in your environment.

Chuck and Ken

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Executive Summary

The *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* describes the value hybrid storage arrays offer to businesses and how the market has changed in the past year.

Hybrid capabilities are permeating the data storage industry as a whole. As the price of flash memory continues to decrease and its lifespan is proven in enterprise storage systems, it is reasonable to expect this market to grow. IDC research indicates that the "worldwide HFA (Hybrid Flash Array) market reached $10.0 billion in 2014."[1] Other forecasts indicate that total flash-optimized market value will grow at a 15% compound annual growth rate from 2013 through 2018.[2]

Hybrid storage arrays are more than traditional arrays with solid state drives (SSDs) filling some of the drive bays. Flash memory may be used in existing non-hybrid arrays today and managed as a new low-latency performance tier. However, traditional storage architectures were designed around the strengths and weaknesses of hard drives as primary storage. This design hampers the performance of flash memory in those arrays.

The primary differentiator for hybrid storage arrays is their flash-optimized software that dynamically caches data and stores it on the most efficient media. In this Buyer's Guide, this functionality is referred to as Automated Storage Tiering (AST). However, some vendors call this capability intelligent caching, intelligent tiering or automated tiering. Whatever the term, the utility is the same.

Why Hybrid, Why Now

Hybrid storage arrays are the current storage system of choice for many small and midsized enterprises. Most hybrid arrays deliver the performance, capacity and capabilities that these enterprises require of their primary storage systems along with reduced management complexity and an attractive price tag as compared to their legacy storage systems.

In this year's guide greater emphasis is placed on the Software and Hardware categories. Software features such as AST, automated provisioning, quality of service (QoS) parameters and capacity optimization options can free IT staff from routine storage administration tasks. By automating these tasks they may focus on advancing the business rather than maintaining the infrastructure. Hardware features such as non-disruptive operation and expansion also add value by reducing storage management overhead.

Performance and Pricing

As with any DCIG Buyer's Guide, specific performance claims are not included in the data even though such claims are often included on vendor data sheets. DCIG does not include this data as performance is too subjective and varies by data center environment, the data being stored, and implementation decisions. Introducing performance metrics would only result in the analysis in this Buyer's Guide becoming more subjective, not less.

As for pricing, each data sheet provides only a starting list price for that array if that information was provided by the vendor. These list prices had no bearing in the weighting of any array and are provided for reference purposes only.

1. "Flash-Based Array Market Proving to Be More Than Just a Flash in the Pan as Market Soars Past $11 Billion in 2014." *www.idc.com*. N.p., 06 Jan. 2015.
2. "32% Y/Y Growth in 2014 for Flash/Hybrid Arrays in EMEA – IDC." StorageNewsletter » 32% Y/Y Growth in 2014 for Flash/Hybrid Arrays in EMEA – IDC. N.p., 03 Feb. 2015.

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Executive Summary (continued)

Conclusion

It is in this context that DCIG presents its *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide.* As prior DCIG Buyer's Guides have done, it puts at the fingertips of organizations a resource that provides buyers with a comprehensive list of hybrid storage arrays that can assist them in this important buying decision while removing much of the mystery around how these arrays are configured and which ones are suitable for which purposes.

This *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* accomplishes the following objectives:

- Provides an objective, third party evaluation of models that evaluates and scores their features from an end user's viewpoint
- Includes recommendations on how to best use this Buyer's Guide
- Scores and ranks the features on each model based upon the criteria that matter most to end users so they can quickly know which models are the most appropriate for them to use and under what conditions
- Provides data sheets for 22 hybrid storage arrays from nine (9) different storage providers so end users can do quick comparisons of the features that are supported and *not* supported on each model
- Provides insight into which features will result in improved performance
- Provide insights into what features each model offers to optimize VMware and Hyper-V virtualization environments
- Gives any organization the ability to request competitive bids from different storage providers that are *apples-to-apples* comparisons

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How to Use this Hybrid Storage Array Buyer's Guide

In determining how to best use the information contained in the *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide,* it is important to note that it is intended to help organizations in their purchase of a hybrid storage array by significantly reducing the time they must invest in researching product features and capabilities. The purpose of this Buyer's Guide is ***NOT*** to tell users exactly which hybrid storage array to purchase. Rather, it is to help guide them in coming up with a list of competitive products that have comparable features that meet their specific needs.

It is also important for users to note that just because a product scored the highest in a particular category or is ranked a certain way does not automatically mean that it is the right product for their organization. If anything, because of the scope of hybrid storage array models evaluated and analyzed, higher ranked models may have features that are too robust for the needs of an individual department or organization.

However, this Buyer's Guide does give users some sense of how each array compares to others classified as "hybrid storage arrays," as well as offering additional insight into what product offerings are available on the market.

DCIG recommends that you use this *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* in the following seven (7) ways:

1. ***Eliminate the painstaking research associated with coming up with a short list of hybrid storage arrays that meet their needs.*** This Buyer's Guide ranks, scores and contains data sheets for 22 different models from nine (9) different providers. Each storage array is scored and then ranked as *Best-in-Class, Excellent, Good* or *Basic* based upon its score. On each array, more than 90 different features were evaluated, weighted, scored and then ranked. All an organization has to do is look at the scores and features of each product in order to come up with a short list of products for consideration.
2. ***Identify comparable apples-to-apples hybrid storage arrays from different storage providers.*** In today's crowded storage market, it behooves organizations to get competitive bids from multiple storage providers. After all, when they compete, you win! But that tactic only works well when organizations know that they are receiving competitive bids on products that are roughly comparable. Using this *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide,* organizations can do a better job of accomplishing that objective.
3. ***Separate the apples from the oranges.*** Just as important as doing apples-to-apples comparisons is identifying when an orange is thrown into the mix. Sometimes it is very difficult for an organization to know if it is truly getting a good deal when bids come in from multiple storage providers that include different models. Now organizations can refer to the scores and rankings of each hybrid storage array in this guide so they know when they are getting a good deal, a great deal or just an adequate one.
4. ***Gain perspective on how models from less well known storage providers compare against established and better known brands.*** Anyone involved with storage at all has at least heard of Dell, HP and other well-known storage vendors. This creates a certain built-in level of comfort when buying products from these companies and a corresponding built-in resistance to buying products from companies that are perceived as unknown quantities.

   This Buyer's Guide helps to remove some of that apprehension about buying from a less well known provider or even a less well known model from an established provider. Using this Buyer's Guide organizations can see how these models from lesser known companies as well as lesser known models from established providers stack up.
5. ***Take advantage of normalized storage terminology.*** Every computing industry has a proclivity to adopt acronyms and jargon that is specific to its lexicon, but the data storage industry seems to go out of its way to not only use unfamiliar terms but refer to the same technology in different ways. This Buyer's Guide sifts through the acronyms and storage jargon and terms and normalizes them. This minimizes or even eliminates the need for users to try to understand all of the industry terminology.
6. ***Do side-by-side comparisons.*** The product data sheets available from the different storage providers are rarely laid out in the same way or contain the same information.

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Some storage providers even have data sheet formats that vary from model to model within their own product portfolio. This Buyer's Guide tackles the problem by creating a standard, easy to read data sheet for every hybrid storage array. In this way, product data sheets for individual products can be printed out, laid down side by side and then quickly compared.

7. ***Justify technical buying recommendations to business folks.*** Nothing is easier for those on the business side to understand than a number. At the top of every hybrid storage array model data sheet, a product score is included so the business side of the house can quickly see how the different storage array models compare.

Disclosures

Over the last few years the general trend in the US has been for both large and boutique analyst firms to receive some or all of their revenue from storage providers. DCIG is no different in this respect as it also receives payment for the different services it performs for storage providers. The services that DCIG provides include blogging, customer validations, product reviews, executive white papers, full length white papers and special reports. For more information on DCIG, visit www.dcig.com.

In the interest of being fully transparent, a number of the storage providers included in this *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* are, or have been DCIG clients. This is not to imply that they were given preferential treatment in the Buyer's Guide. All it meant was that DCIG was aware that they offered arrays that might qualify for inclusion in this Buyer's Guide and that DCIG had more initial knowledge of their hybrid storage arrays.

In that vein, there are a number of important facts to keep in mind when considering the information contained in this *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* and its merit.

- No storage provider paid DCIG any fee to develop this Buyer's Guide.
- DCIG did not guarantee any storage provider that its hybrid storage array(s) would be included in this Buyer's Guide.
- DCIG did not imply or guarantee that a specific hybrid storage array model would receive a good score on this Buyer's Guide ahead of time.
- All research was based upon publicly available information, information provided by the storage provider and the expertise of those evaluating the information.
- Because of the number of features analyzed, how these features were weighted and then how these hybrid storage array models were scored and then ranked, there was no way for DCIG to predict at the outset how individual hybrid storage array models would end up scoring or ranking.

DCIG would like to emphasize that no storage provider was privy to how DCIG did the scoring and ranking of the hybrid arrays. In every case the storage providers only found out the scores and rankings of its array model(s) after the analysis was complete.

Hybrid Storage Array Inclusion and Exclusion Criteria

The inclusion and exclusion of specific hybrid storage array models in this Buyer's Guide is based on the follow criteria:

- Must dynamically place data in a storage pool that combines flash memory and HDD storage resources (and in some cases NVRAM and/or DRAM) by intelligently caching data and metadata and/or by automatically moving data from one performance tier to another.
- Must support one or more of the following storage networking protocols:
  - Fibre Channel and/or FCoE, iSCSI, NFS
- Must primarily function using storage local to the array, storage expansion units and/or its direct peers and must function as more than a private or public cloud storage gateway
- Must support scaling to a minimum of 12 disks and 10 TB of raw capacity
- Has a maximum raw capacity of ***less than*** 500 TB
- Must be available as an appliance that is available as a single SKU and includes its own hardware and software.

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- Must provide sufficient information for DCIG to draw a meaningful conclusion.
- Must be generally available on February 13, 2015.

The 8-Step Process Used to Score and Rank Hybrid Storage Arrays

To score and rank each hybrid storage array model, DCIG went through an eight (8) step process to come to the most objective conclusion possible.

1. ***DCIG listed out all of the features available on all of the hybrid storage arrays.*** Prior to selecting the features that were included in the final evaluation in the Buyer's Guide, DCIG went through and quantified what features hybrid arrays possessed. As part of this process, DCIG *"normalized"* the list of features available on hybrid storage arrays such that a common name for each feature was established.
2. ***DCIG established which features would be included in the Buyer's Guide and which ones would not.*** One of the goals of this Buyer's Guide was to try to only include features on each hybrid storage array model that could be objectively and authoritatively analyzed.

   For example, *"Raw Storage Capacity (Max SSD/Max)"* was evaluated as a feature instead of *"Useable Storage Capacity."* While useable storage capacity is what users ultimately care about, a consistent objective answer cannot be arrived at as most hybrid storage arrays offer multiple RAID options and differences in data compression and deduplication by type of data yield site-specific useable or effective storage capacity. Therefore, *"Maximum Raw Storage Capacity"* was selected as the feature to be evaluated since an objective answer could be ascertained and supported.
3. ***The features were broken down into five general categories.*** The features included in this Buyer's Guide broke down into a total of five broad categories that are reflected on each hybrid storage array data sheet. These categories include Software, Hardware, Management, Virtualization and Support.
4. ***Each feature had a weighting associated with it.*** The weightings were used to reflect if a feature was supported and potentially how valuable the feature is to an end-user compared to other options. For example, the *"Synchronous Replication"* feature is more of a *"Yes"* or *"No"* type of response whereas *"Snapshot Methods"* covers a number of snapshot options. Each of these options is weighted and scored differently.
5. ***DCIG completed a survey for each vendor's product(s) and then sent the survey(s) to each vendor for verification.*** Each vendor was invited to review their data and respond with any corrections or edits to the DCIG-completed survey(s).
6. ***All vendors were given the opportunity to review their data sheets before the final scores and rankings were determined.*** To ensure the information presented in this Buyer's Guide is as complete and correct as possible, DCIG provided each vendor a copy or copies of their filled-out surveys and the data sheets that appear in this Buyer's Guide *without the scores and rankings on them.* In this way they had the opportunity to validate the information and correct it before it was publicly released.
7. ***All of the features were scored based upon the information that was gathered.*** The weighting and scoring of the features were done by a DCIG research analyst.
8. ***The hybrid storage arrays were ranked using standard scoring techniques.*** One of the goals of this Buyer's Guide is to establish clear lines of differentiation between hybrid arrays with conclusions that are arrived at objectively. To accomplish this goal, the mean or average score for each classification was first determined and then the standard deviation.

Using the mean of the scores from all of the hybrid storage arrays from which the standard deviation was calculated, DCIG developed a ranking for each array model based upon the following in each classification:

- Those models that were .5 or greater standard deviations below the mean were given the rank of *"Basic."*
- Those models that were .5± standard deviations above or below the mean were ranked as *"Good."*
- Those models that were .5 – 1.25 standard deviations above the mean were ranked as *"Excellent."*
- The model(s) with the highest score in each category were given the designation of *"Best-in-Class."*

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It is for this reason that in each category the number of models that achieved a certain ranking varied. DCIG feels confident that all of the models included in this report could be classified as a hybrid storage array suitable for use by a small or midsized enterprise.

DCIG Comments and Thoughts

It could be said that hybrid storage arrays offer the best of both worlds. By combining flash memory with hard disk drives, they strike a balance between performance, capacity and cost. Because the majority of the data will ultimately be stored on slower HDD instead of flash memory, the trick is to achieve consistently high performance without 100% flash. The secret sauce the hybrid storage array providers bring to the table is a combination of storage architecture, hardware, and software features.

The Business Value of a Hybrid Storage Array

Traditional storage array architectures are not optimized for the use of flash. These arrays cannot keep up with the highly variable, random I/O demands of today's virtualized data centers which leads to desired business results being hampered by inadequate storage system performance.

Hybrid storage arrays deliver most of the performance benefits of an all-flash array but at a lower cost. In addition, by combining flash memory and high-capacity HDDs in a single system, a hybrid storage array can be used for a broader set of applications than a smaller capacity all-flash array though some flash memory storage arrays are closing this capacity gap. Managing greater storage capacity from a single interface adds to the financial benefits a business realizes by reducing overall storage management costs.

How a Hybrid Storage Array Differs From a Traditional Array

Many traditional arrays incorporate flash memory as a cache or as a high performance storage tier. In contrast, a hybrid storage array is architected for flash memory and generally adopts a "flash first" approach to storage. A hybrid storage array uses AST algorithms, which are often combined with in-line deduplication and compression, to maximize the amount of storage I/Os that are satisfied from high speed cache and flash memory.

Using this "flash first" design, many hybrid storage arrays contain only flash memory and high capacity multi-terabyte 7.2K RPM SAS or SATA hard disk drives. This setup allows hybrid storage arrays to bypass expensive and lower capacity 15K and 10K SAS/FC hard disk drives which minimizes complexity and expense.

Automated Tiering / Caching Capabilities

Automated storage tiering and caching capabilities are the most significant differentiator between hybrid storage arrays and all-flash or traditional arrays. Organizations want to ensure that the hybrid storage array always satisfies I/O requests using the higher performing flash tier. Hybrid storage arrays employ various strategies to achieve optimum tiering results that include:

- More DRAM cache than in traditional storage arrays
- In-line deduplication and/or compression of data in cache, SSD and HDD
- Metadata stored separately from file data on high performance media
- Separate and dedicated read & write caches on optimal media

This Buyer's Guide reveals that dynamic (real-time) AST with preset policies is used by eighteen (18) arrays (82% of the total), while ten (10) of the arrays (45% of the total) offer dynamic AST with user-defined policies. Nine (9) arrays (41% of the total) support automated tiering per VM and thirteen (13) support this functionality per LUN (59% of the total.) Thirteen (13) of the twenty-two arrays (59% of the total) support in-line deduplication and/or in-line compression, while seventeen (17) of the arrays (77% of the total) support the use of flash as a read cache and thirteen (13) of the arrays (59% of the total) use flash as a write cache.

Automated Performance Tuning and Monitoring

Fine tuning a traditional storage array for optimal performance can be an arduous task that does not provide dynamic tuning. Hybrid storage arrays eliminate ongoing performance management chores by implementing tuning via pre-set algorithms.

Arrays that implement QoS require some initial configuration and assignment of VM/LUNs/Volumes to QoS policies with the payoff that the most important workloads get priority over less important workloads. Eight (8) of the twenty-two arrays (36% of the total) support user-defined guaranteed IOPS and/or pre-defined service levels per VM/

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LUN/Volume. Thirteen (13) arrays (59% of the total) automatically balance IOPS across all VM/LUN/Volumes.

Visibility into the performance of the storage system is important for troubleshooting application performance issues. Some providers implement VM-aware monitoring that reveals performance at the virtual machine level. Fourteen (14) arrays (64% of the total) provide per VM performance statistics.

Virtualization Integration

VMware ESX is still the dominant hypervisor in most enterprises with twenty (20) arrays (91% of the total) supporting management from within vSphere/vCenter though Microsoft, Red Hat and Citrix are making inroads. Already fifteen (15) of these arrays (68% of the total) can be managed from within Microsoft System Center 2012 (SCVMM).

Hypervisor vendors provide application programming interfaces (API) for provisioning, I/O offload, management, and reporting. Arrays that implement these APIs improve the way servers and storage work together and enhance overall data center efficiency. Storage vendors have taken this to heart, as demonstrated by the following:

- 95% of the arrays support VMware VAAI Block Zeroing
- 91% of the arrays support VMware VAAI Hardware Assisted Locking
- 86% of the arrays support VMware SIOC
- 82% of the arrays support VMware VAAI Full Copy
- 73% of the arrays support VMware VASA
- 32% of the arrays support Microsoft ODX

Included Software

A number of hybrid storage arrays ship with all software features included at no extra charge. This practice creates a single standard hybrid storage array package that *reduces the number of decision points* in the purchasing process. This simplified approach to licensing also increases the agility of an IT department in responding to changing business requirements as compared to the traditional a-la-carte licensing model.

This Buyer's Guide identified six (6) different features that are sometimes licensed a-la-carte. Over half of the hybrid arrays included all six (6) of these features in the base cost of the array.

Old School versus New School

The early hybrid storage arrays were engineered from the ground up to address the business need for high-performing, high-capacity storage for virtualized infrastructures. These arrays came from startup companies, many of them led by industry veterans.

While traditional storage vendors were slow to address this new market, most have now taken steps to bring hybrid storage arrays to markets. Some existing architectures were flexible enough to fully embrace a true hybrid model. To do so, some vendors re-wrote portions of their storage software to take better advantage of flash memory. Others acquired one of the hybrid startups, or came out with their own line of hybrid arrays. As a result, this Guide reflects a diverse mix of relative new-comers and long-established storage industry vendors alike.

A major point of differentiation between many of the hybrid storage arrays, regardless if they come from existing or new providers, is the maturity of the data management service software used on the array. Enterprises contemplating the purchase of a hybrid storage array should closely examine these features, which one or ones they are going to use and verify that the maturity and reliability of the features they intend to use meet the requirements of the business.

Performance and Pricing

Two factors that strongly influence buying decisions are performance and cost. Therefore it may come as a surprise to those who look at this *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide* to see no performance benchmarks as to how any of the arrays performed, and only high-level pricing information. There are two core reasons why performance or detailed pricing information are not included in this Buyer's Guide.

First, performance results vary according to data center environment, the data being stored, and implementation decisions. Introducing any type of performance metric would only result in the analysis and evaluations of the arrays included in this Buyer's Guide becoming more subjective, not less.

Second, this Buyer's Guide is intended to provide a point-in-time snapshot of hybrid storage array marketplace. If DCIG had tried to test and establish performance benchmarks for all of these arrays, the next generation of arrays

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could well be available before the testing was completed, making this Buyer's Guide obsolete before it ever saw the light of day.

As for pricing, each data sheet provides only a starting list price for an array, if the vendor provided one or DCIG could identify one that was publicly available. Many factors influence final price including capacity purchased, services, extended warranties, negotiations, etc. The listed prices had no bearing in the weighting of any array and are provided for reference purposes only.

DCIG recognizes that price and performance are relevant and often key considerations when buying a hybrid storage array. However, it is also almost impossible for a third party like DCIG to objectively measure these features on a large scale. Therefore, evaluating these factors is a part of the buying process that is still best left to end users.

DCIG Observations & Recommendations

Best-in-Class Ranking

Observations

The Tegile T3400 earned the *Best-in-Class* ranking among SME Hybrid Storage Arrays evaluated in this Buyer's Guide. In comparison to its counterparts, this array stood out in the following ways:

- Best balance of strengths across all scoring categories

Recommendations

Tegile recently updated its storage array offerings and while the T3400 is not one of the newly announced models, it is anything but long in the tooth. Introduced in June 2014, the Tegile T3400 shares the same code base as all of the T3x00 series product line. The T3400 array incorporates 28.2 TB of raw flash capacity in a 2U form factor. The T3400 can function either as a hybrid array or as an all-flash array depending on which shelves are used for expanded storage.

The IntelliFlash architecture is at the heart of all of these arrays providing the caching algorithms and metadata acceleration used to optimize performance. The array also supports what Tegile calls FlashVols. FlashVols are volumes pinned in flash memory, bypassing caching algorithms and guaranteeing that 100% of storage operations on that volume occur in flash memory.

Tegile's IntelliFlash Metadata Accelerated technology separates metadata from the primary data path and stores the metadata on high-performance memory devices. The separation of data optimizes functions such as deduplication, compression and snapshots, while simultaneously accelerating all I/O.

Tegile claims existing clients experience up to a five times increase in effective capacity using its deduplication and compression algorithms. Because deduplication and compression occur in front of the cache, they also boost the effective capacity of the already impressive amount of 192 GB of cache.

The T3400's real-time caching/ automated storage tiering can be configured system-wide, per VM and/or per volume using either preset or user-defined policies. While its performance monitoring application provides insight on a system-wide, per VM/LUN/volume, front-end port and disk pool level.

Managing the T3400 is intuitive via a web-based interface. VMware vCenter and Microsoft Systems Center Virtual Machine Manager (SCVMM) can also be used to manage data stores running on the T3400. Scripting recurring tasks is accomplished through REST APIs. Quotas can be implemented for users, groups, files and/or directories.

The T3400 scored *Excellent* in the Virtualization category by supporting Microsoft ODX as well as all of the VMware vSphere VAAI features evaluated. VMware's SIOC, Storage DRS and ALUA are also supported by this array.

Excellent Ranking

Observations

Tegile's T3200, T3300 and T3100, NexGen Storage's N5-1000, N5-500, N5-300, N5-200 and iXsystems TrueNAS Z20 comprise the *Excellent* category. Arrays scoring in the *Excellent* range distinguished themselves by superior software features across the board.

Recommendations

All of the Tegile arrays share the same architecture and software as the *Best-in-Class* T3400. These arrays differ from one another in hardware capacities including cache

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size, CPU cores, flash memory and HDD capacities. The Tegile arrays outscored all other arrays in this ranking category in Virtualization and were held back from an *Excellent* ranking in the Support category only by their relatively short 90-day warranty.

The NexGen N5-1000, N5-500, N5-300, N5-200 arrays also differ from one another only in hardware capacities. These arrays actually edged out the Tegile arrays to achieve *Best-in-Class* in the Management and Software categories. NexGen's robust software capabilities include solid QoS options, comprehensive performance monitoring, along with extensive automation and provisioning options. NexGen arrays may also be managed through a wide variety of interfaces ranging from a console port to a web UI and even a mobile application.

The iXsystems TrueNAS Z20 edged out the Tegile T3400 for *Best-in-Class* honors in the Hardware category due in part to greater storage density and support for more self-healing techniques, but has less complete Management and Virtualization features compared to the other *Excellent* arrays.

Good Ranking

Observations

Five arrays achieved the Good ranking in this Buyer's Guide: Hitachi Data Systems HUS 110, Dell Storage SC4020, Dell EqualLogic PS6210XS, Nimble Storage CS500 and CS300. Arrays in the *Good* ranking are characterized by:

- Received *Good* or better in at least three scoring categories
- Hardware scores in the same range as the *Excellent* arrays
- Software scores lower than the *Excellent* arrays

Recommendations

The Hitachi Data Systems HUS 110 scored *Best-in-Class* in Virtualization among all arrays, and also attained an *Excellent* in the Hardware and Support categories, but was held back by lower scores in Software and Management compared to the *Excellent* arrays.

Dell targets the SC4020 for small to medium sized businesses. Dell even calls it the "Baby Compellent" in some of its marketing collateral. As such, it may not surprising that it scored lower than arrays targeting the enterprise market.

Likewise, the Nimble Storage arrays are more focused on the small and midsized business (SMB) marketplace than enterprises. Nevertheless, its current generation of hardware and software gives Nimble arrays an opportunity to expand upward into small, midsize and large enterprises to address their needs as well.

Basic Ranking

Observations

Arrays achieving a ranking of *Basic* deliver a mix of smaller vendors along with a couple industry stalwarts. *Basic* arrays include the HP StoreVirtual 4335 Hybrid Storage, Dell EqualLogic PS4210XS, Nimble Storage CS215, X-IO Technologies ISE 740, 730, 720, 710 and AMI's StorTrends 3500i. *Basic* arrays have less robust features overall as most achieve only a Basic ranking in two or more categories.

Recommendations

When considering an array ranked as *Basic,* an organization should have a solid grasp on its particular business requirements and then let those needs determine which solution is the best fit. A *Basic* array may be perfectly suitable to address the need that prompted the organization to begin looking at hybrid arrays in the first place.

Like some of the *Good* ranking arrays, most of the *Basic* arrays are marketed primarily in the SMB space. While these arrays typically provide less features and functionality than their higher scoring competitors, they generally are offered at a lower purchase price.

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SMALL/MIDSIZE ENTERPRISE HYBRID STORAGE ARRAY SCORES AND RANKINGS

The scores and rankings for the enterprise midrange arrays contain the following information:

- A chart that includes the scores and rankings for all of the products
- The mean and the standard deviation that were used to establish how enterprise midrange arrays were ranked
- A summary of the primary findings

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2015-16 SMALL/MIDSIZE ENTERPRISE HYBRID STORAGE ARRAY BUYER'S GUIDE

A comparison of hybrid storage arrays from enterprise storage providers

OVERALL SCORES AND RANKINGS

	SME HYBRID STORAGE ARRAYS	SCORES	RANKING
1.	**Tegile T3400**	**106.44**	**Best-in-Class**
2.	Tegile T3200	101.67	Excellent
3.	Tegile T3300	101.48	Excellent
4.	Tegile T3100	100.89	Excellent
5.	NexGen N5-1000 Hybrid Flash Array	96.95	Excellent
6.	NexGen N5-500 Hybrid Flash Array	96.15	Excellent
7.	NexGen N5-300 Hybrid Flash Array	96.14	Excellent
8.	NexGen N5-200 Hybrid Flash Array	95.12	Excellent
9.	iXsystems TrueNAS Z20	93.58	Excellent
10.	Hitachi Data Systems HUS 110	85.11	Good
11.	Dell Storage SC4020	80.50	Good
12.	Dell EqualLogic PS6210XS	74.80	Good
13.	Nimble Storage CS500	70.99	Good
14.	Nimble Storage CS300	69.87	Good
15.	HP StoreVirtual 4335 Hybrid Storage	68.07	Basic
16.	Dell EqualLogic PS4210XS	64.49	Basic
17.	Nimble Storage CS215	64.18	Basic
18.	X-IO Technologies ISE 740 G3 Hybrid Storage Array	59.47	Basic
19.	X-IO Technologies ISE 730 G3 Hybrid Storage Array	59.16	Basic
20.	X-IO Technologies ISE 720 G3 Hybrid Storage Array	59.06	Basic
21.	X-IO Technologies ISE 710 G3 Hybrid Storage Array	59.05	Basic
22.	AMI StorTrends 3500i	40.19	Basic

Total Number of Products	22

		Rankings	
Highest Score	106.44	Recommended	102.81 – 106.44
Lowest Score	40.19	Excellent	88.67 – 102.80
Average (Mean)	79.24	Good	69.82 – 88.66
Standard Deviation	18.85	Basic	40.19 – 69.81

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SMALL/MIDSIZE ENTERPRISE HYBRID STORAGE ARRAY PRODUCTS

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AMI StorTrends 3500i

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
40.19	13.37	14.47	5.35	2.10	4.90
BASIC	BASIC	BASIC	BASIC	BASIC	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✗ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✓
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✓
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✓
Automated/Policy-based Provisioning *TOTAL #*	✗
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	1
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	2
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✓ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	4
Remote Monitoring / Proactive Remediation	✓ / ✗
Hardware Warranty	5 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	8 TB
Raw Storage Capacity *MAX*	60 TB
Raw Storage Density per Rack Unit *MAX*	20 TB/U
Self-healing Technologies *TOTAL #*	✗
DRAM Cache *MAX, 2 CONTROLLERS*	32 GB
CPU Cores *MAX, 2 CONTROLLERS*	16
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	2
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✗ / ✗
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	5
Storage Networking Ports *MAX*	2
Ethernet Ports 1 / 10 Gb *MAX*	2 / 2
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	✗
Controller Addition / Replacement	✗ / ✗
Controller Code Upgrades	✗
Storage Shelf or Node Addition	✗

MANAGEMENT

Feature License Included *TOTAL #*	4
AST / Performance Monitoring	✗ / ✓
Replication / Snapshots	✗ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	2
vSphere / SCVMM	✓ / ✗
OpenStack / SMI-S	✗ / ✗
Performance Monitoring Granularities *TOTAL #*	2
Notification and Logging *TOTAL #*	1

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✗ / ✗
HAL / Dead Space Reclamation	✗ / ✗
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✗ / ✗
AQDT / SIOC	✗ / ✗
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✗ / ✗

✓ Supported ✗ Unsupported

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Dell EqualLogic PS4210XS

Approximate Starting List Price: $65,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
64.49	13.25	16.46	16.50	11.93	6.35
BASIC	BASIC	BASIC	EXCELLENT	EXCELLENT	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	3
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✓
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✓
Automated/Policy-based Provisioning *TOTAL #*	4
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✗
QoS Options *TOTAL #*	✗
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	9
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	1 Year

HARDWARE

Raw SSD-only Storage Capacity *MAX*	5.6 TB
Raw Storage Capacity *MAX*	26 TB
Raw Storage Density per Rack Unit *MAX*	6.5 TB/U
Self-healing Technologies *TOTAL #*	1
DRAM Cache *MAX, 2 CONTROLLERS*	16 GB
CPU Cores *MAX, 2 CONTROLLERS*	2
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✗ / ✗
Flash-based Caching *TOTAL #*	2
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✗ / ✗
NAS Acceleration	✗
Scale-out	✓
Concurrent SAN & NAS	✗
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	9
Storage Networking Ports *MAX*	4
Ethernet Ports 1 / 10 Gb *MAX*	4 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	6
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	8
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	5
Notification and Logging *TOTAL #*	5

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✓
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✓ / ✓
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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Dell EqualLogic PS6210XS

Approximate Starting List Price: $81,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
74.80	14.50	25.97	15.55	11.93	6.85
GOOD	BASIC	GOOD	GOOD	EXCELLENT	GOOD

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	3
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✓
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✓
Automated/Policy-based Provisioning *TOTAL #*	1
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✗
QoS Options *TOTAL #*	✗
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	4
SSD Optimization Methods *TOTAL #*	1
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	7
Remote Monitoring / Proactive Remediation	✓ / ✗
Hardware Warranty	3 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	89.6 TB
Raw Storage Capacity *MAX*	416 TB
Raw Storage Density per Rack Unit *MAX*	13 TB/U
Self-healing Technologies *TOTAL #*	1
DRAM Cache *MAX, 2 CONTROLLERS*	32 GB
CPU Cores *MAX, 2 CONTROLLERS*	8
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✗ / ✗
Flash-based Caching *TOTAL #*	✗
Read / Write	✗ / ✗
Write Journaling / Block IO Acceleration	✗ / ✗
NAS Acceleration	✗
Scale-out	✓
Concurrent SAN & NAS	✓
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	6
Storage Networking Ports *MAX*	4
Ethernet Ports 1 / 10 Gb *MAX*	4 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	6
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	8
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	2
Notification and Logging *TOTAL #*	5

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✓
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✓ / ✓
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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Dell Storage SC4020

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
80.50	19.50	28.42	15.05	10.53	7.00
GOOD	GOOD	GOOD	GOOD	GOOD	GOOD

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✓ / ✓
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	3
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✓
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✓
Compression *INLINE / POST-PROCESS*	✗ / ✓
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✗
Automated/Policy-based Provisioning *TOTAL #*	5
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	1
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	5
SSD Optimization Methods *TOTAL #*	✗
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	7
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	3 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	192 TB
Raw Storage Capacity *MAX*	408 TB
Raw Storage Density per Rack Unit *MAX*	51 TB/U
Self-healing Technologies *TOTAL #*	2
DRAM Cache *MAX, 2 CONTROLLERS*	32 GB
CPU Cores *MAX, 2 CONTROLLERS*	8
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	1
Read / Write	✓ / ✗
Write Journaling / Block IO Acceleration	✗ / ✗
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✓
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	7
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	4 / 4
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	5
Controller Addition / Replacement	✗ / ✗
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	2
AST / Performance Monitoring	✗ / ✓
Replication / Snapshots	✗ / ✗
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	8
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✗ / ✓
Performance Monitoring Granularities *TOTAL #*	4
Notification and Logging *TOTAL #*	5

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✓ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✗
Full File Clone / Out-of-space	✓ / ✗
Reserve Space / Extended Statistics	✗ / ✓
VASA / VADP	✓ / ✓
AQDT / SIOC	✗ / ✗
VASRM / PSA	✓ / ✗
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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Hitachi Data Systems HUS 110

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
85.11	23.12	32.26	7.30	13.23	9.20
GOOD	GOOD	EXCELLENT	BASIC	BEST-IN-CLASS	RECOMMENDED

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✓ / ✓
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	5
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✓
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✓
Compression *INLINE / POST-PROCESS*	✗ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	2
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✓ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✗
QoS Options *TOTAL #*	✗
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	4
SSD Optimization Methods *TOTAL #*	5
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✓ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	3 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	48 TB
Raw Storage Capacity *MAX*	480 TB
Raw Storage Density per Rack Unit *MAX*	46 TB/U
Self-healing Technologies *TOTAL #*	3
DRAM Cache *MAX, 2 CONTROLLERS*	48 GB
CPU Cores *MAX, 2 CONTROLLERS*	8
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	1
Read / Write	✓ / ✗
Write Journaling / Block IO Acceleration	✗ / ✗
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✓
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	12
Ethernet Ports 1 / 10 Gb *MAX*	4 / 4
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	5
Controller Addition / Replacement	✗ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✗

MANAGEMENT

Feature License Included *TOTAL #*	2
AST / Performance Monitoring	✗ / ✓
Replication / Snapshots	✗ / ✗
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	5
vSphere / SCVMM	✗ / ✗
OpenStack / SMI-S	✗ / ✗
Performance Monitoring Granularities *TOTAL #*	1
Notification and Logging *TOTAL #*	7

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✓
RHEV / VMware	✓ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✓ / ✓
Reserve Space / Extended Statistics	✓ / ✓
VASA / VADP	✓ / ✓
AQDT / SIOC	✓ / ✓
VASRM / PSA	✓ / ✓
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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HP StoreVirtual 4335 Hybrid Storage

Approximate Starting List Price: $41,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
68.07	14.25	21.74	13.05	10.53	8.50
BASIC	BASIC	BASIC	GOOD	GOOD	EXCELLENT

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	3
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✗ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✗
Automated/Policy-based Provisioning *TOTAL #*	2
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✗
QoS Options *TOTAL #*	1
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	2
SSD Optimization Methods *TOTAL #*	4
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	3 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	1.2 TB
Raw Storage Capacity *MAX*	240 TB
Raw Storage Density per Rack Unit *MAX*	7.5 TB/U
Self-healing Technologies *TOTAL #*	1
DRAM Cache *MAX, 2 CONTROLLERS*	64 GB
CPU Cores *MAX, 2 CONTROLLERS*	6
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✗ / ✓
Flash-based Caching *TOTAL #*	2
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✗ / ✗
NAS Acceleration	✗
Scale-out	✓
Concurrent SAN & NAS	✓
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	11
Storage Networking Ports *MAX*	6
Ethernet Ports 1 / 10 Gb *MAX*	4 / 2
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	4
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✗

MANAGEMENT

Feature License Included *TOTAL #*	5
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	10
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✓
Performance Monitoring Granularities *TOTAL #*	3
Notification and Logging *TOTAL #*	4

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✓
RHEV / VMware	✓ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✓ / ✓
Reserve Space / Extended Statistics	✓ / ✓
VASA / VADP	✓ / ✓
AQDT / SIOC	✗ / ✓
VASRM / PSA	✓ / ✗
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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iXsystems TrueNAS Z20

Approximate Starting List Price: $9,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
93.58	28.87	39.44	10.85	8.12	6.30
EXCELLENT	EXCELLENT	BEST-IN-CLASS	BASIC	BASIC	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✓ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	4
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	1
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	8
SSD Optimization Methods *TOTAL #*	5
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✓ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	7
Remote Monitoring / Proactive Remediation	✓ / ✗
Hardware Warranty	3 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	80 TB
Raw Storage Capacity *MAX*	320 TB
Raw Storage Density per Rack Unit *MAX*	45.7 TB/U
Self-healing Technologies *TOTAL #*	3
DRAM Cache *MAX, 2 CONTROLLERS*	64 GB
CPU Cores *MAX, 2 CONTROLLERS*	8
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✗ / ✗
Flash-based Caching *TOTAL #*	5
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✓
Scale-out	✗
Concurrent SAN & NAS	✓
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	10
Ethernet Ports 1 / 10 Gb *MAX*	10 / 8
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	6
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	5
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	7
vSphere / SCVMM	✗ / ✗
OpenStack / SMI-S	✗ / ✗
Performance Monitoring Granularities *TOTAL #*	6
Notification and Logging *TOTAL #*	4

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✓
RHEV / VMware	✗ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✓
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✗ / ✗
AQDT / SIOC	✗ / ✗
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✗ / ✗

✓ Supported ✗ Unsupported

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NexGen N5-200 Hybrid Flash Array

Approximate Starting List Price: $55,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
95.12	33.87	27.82	17.60	9.43	6.40
EXCELLENT	BEST-IN-CLASS	GOOD	BEST-IN-CLASS	GOOD	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	4
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	8
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✓ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	10
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	7
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	7.2 TB
Raw Storage Capacity *MAX*	128 TB
Raw Storage Density per Rack Unit *MAX*	10.67 TB/U
Self-healing Technologies *TOTAL #*	2
DRAM Cache *MAX, 2 CONTROLLERS*	192 GB
CPU Cores *MAX, 2 CONTROLLERS*	24
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✓
Flash-based Caching *TOTAL #*	4
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	8 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	7
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	10
vSphere / SCVMM	✓ / ✗
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	8

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✗
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✓
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✓
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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NexGen N5-300 Hybrid Flash Array

Approximate Starting List Price: $99,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
96.14	33.87	28.84	17.60	9.43	6.40
EXCELLENT	BEST-IN-CLASS	GOOD	BEST-IN-CLASS	GOOD	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	4
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	8
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✓ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	10
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	7
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	7.8 TB
Raw Storage Capacity *MAX*	256 TB
Raw Storage Density per Rack Unit *MAX*	21.33 TB/U
Self-healing Technologies *TOTAL #*	2
DRAM Cache *MAX, 2 CONTROLLERS*	192 GB
CPU Cores *MAX, 2 CONTROLLERS*	24
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✓
Flash-based Caching *TOTAL #*	4
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	8 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	7
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	10
vSphere / SCVMM	✓ / ✗
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	8

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✗
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✓
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✓
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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NexGen N5-500 Hybrid Flash Array

Approximate Starting List Price: $169,488

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
96.15	33.87	28.85	17.60	9.43	6.40
EXCELLENT	BEST-IN-CLASS	GOOD	BEST-IN-CLASS	GOOD	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	4
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	8
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✓ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	10
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	7
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	10.4 TB
Raw Storage Capacity *MAX*	256 TB
Raw Storage Density per Rack Unit *MAX*	21.33 TB/U
Self-healing Technologies *TOTAL #*	2
DRAM Cache *MAX, 2 CONTROLLERS*	192 GB
CPU Cores *MAX, 2 CONTROLLERS*	24
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✓
Flash-based Caching *TOTAL #*	4
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	8 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	7
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	10
vSphere / SCVMM	✓ / ✗
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	8

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✗
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✓
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✓
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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NexGen N5-1000 Hybrid Flash Array

Approximate Starting List Price: $199,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
96.95	33.87	29.65	17.60	9.43	6.40
EXCELLENT	BEST-IN-CLASS	EXCELLENT	BEST-IN-CLASS	GOOD	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	4
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	8
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✓ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	10
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	7
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	15.6 TB
Raw Storage Capacity *MAX*	256 TB
Raw Storage Density per Rack Unit *MAX*	21.33 TB/U
Self-healing Technologies *TOTAL #*	2
DRAM Cache *MAX, 2 CONTROLLERS*	192 GB
CPU Cores *MAX, 2 CONTROLLERS*	24
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✓
Flash-based Caching *TOTAL #*	4
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	8 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	7
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	10
vSphere / SCVMM	✓ / ✗
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	8

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✗
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✓
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✓
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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Nimble Storage CS215

Approximate Starting List Price: $40,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
64.18	17.75	17.25	14.70	8.63	5.85
BASIC	GOOD	BASIC	GOOD	GOOD	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	6
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	3
Data Migration to Cloud	✓
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	7
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	1 Year

HARDWARE

Raw SSD-only Storage Capacity *MAX*	1.2 TB
Raw Storage Capacity *MAX*	12 TB
Raw Storage Density per Rack Unit *MAX*	4 TB/U
Self-healing Technologies *TOTAL #*	2
DRAM Cache *MAX, 2 CONTROLLERS*	24 GB
CPU Cores *MAX, 2 CONTROLLERS*	8
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✗ / ✗
Flash-based Caching *TOTAL #*	2
Read / Write	✓ / ✗
Write Journaling / Block IO Acceleration	✓ / ✗
NAS Acceleration	✗
Scale-out	✓
Concurrent SAN & NAS	✗
FC / iSCSI	✗ / ✓
Redundant/Hot-swap Components *TOTAL #*	8
Storage Networking Ports *MAX*	4
Ethernet Ports 1 / 10 Gb *MAX*	4 / 2
FC Ports 8 / 16 Gb *MAX*	✗ / ✗
Non-disruptive Operations *TOTAL #*	7
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	6
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✓
Performance Monitoring Granularities *TOTAL #*	4
Notification and Logging *TOTAL #*	4

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✗ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✓
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✓ / ✗
Storage DRS / ALUA	✗ / ✓

✓ Supported ✗ Unsupported

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Nimble Storage CS300

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
69.87	17.75	22.94	14.70	8.63	5.85
GOOD	GOOD	GOOD	GOOD	GOOD	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	6
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	3
Data Migration to Cloud	✓
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	7
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	1 Year

HARDWARE

Raw SSD-only Storage Capacity *MAX*	16 TB
Raw Storage Capacity *MAX*	288 TB
Raw Storage Density per Rack Unit *MAX*	24 TB/U
Self-healing Technologies *TOTAL #*	2
DRAM Cache *MAX, 2 CONTROLLERS*	24 GB
CPU Cores *MAX, 2 CONTROLLERS*	8
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✗ / ✗
Flash-based Caching *TOTAL #*	2
Read / Write	✓ / ✗
Write Journaling / Block IO Acceleration	✓ / ✗
NAS Acceleration	✗
Scale-out	✓
Concurrent SAN & NAS	✗
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	8
Storage Networking Ports *MAX*	6
Ethernet Ports 1 / 10 Gb *MAX*	6 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / 2
Non-disruptive Operations *TOTAL #*	7
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	6
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✓
Performance Monitoring Granularities *TOTAL #*	2
Notification and Logging *TOTAL #*	4

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✗ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✓
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✓ / ✗
Storage DRS / ALUA	✗ / ✓

✓ Supported ✗ Unsupported

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Nimble Storage CS500

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
70.99	17.75	24.06	14.70	8.63	5.85
GOOD	GOOD	GOOD	GOOD	GOOD	BASIC

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	6
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	✓
Data Migration to Cloud	✓
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✗

SUPPORT

Contract Support Methods *TOTAL #*	7
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	1 Year

HARDWARE

Raw SSD-only Storage Capacity *MAX*	32 TB
Raw Storage Capacity *MAX*	288 TB
Raw Storage Density per Rack Unit *MAX*	24 TB/U
Self-healing Technologies *TOTAL #*	✗
DRAM Cache *MAX, 2 CONTROLLERS*	24 GB
CPU Cores *MAX, 2 CONTROLLERS*	8
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✗ / ✗
Flash-based Caching *TOTAL #*	2
Read / Write	✓ / ✗
Write Journaling / Block IO Acceleration	✓ / ✗
NAS Acceleration	✗
Scale-out	✓
Concurrent SAN & NAS	✗
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	8
Storage Networking Ports *MAX*	6
Ethernet Ports 1 / 10 Gb *MAX*	6 / 4
FC Ports 8 / 16 Gb *MAX*	✗ / 4
Non-disruptive Operations *TOTAL #*	7
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	6
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✓
Performance Monitoring Granularities *TOTAL #*	4
Notification and Logging *TOTAL #*	4

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✗ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✗ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✓
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✓ / ✗
Storage DRS / ALUA	✗ / ✓

✓ Supported ✗ Unsupported

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Tegile T3100

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
100.89	31.87	32.64	16.05	12.38	7.95
EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	GOOD

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	2
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	2
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	6
SSD Optimization Methods *TOTAL #*	5
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	.75 TB
Raw Storage Capacity *MAX*	170 TB
Raw Storage Density per Rack Unit *MAX*	14 TB/U
Self-healing Technologies *TOTAL #*	1
DRAM Cache *MAX, 2 CONTROLLERS*	96 GB
CPU Cores *MAX, 2 CONTROLLERS*	16
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	5
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✓
Scale-out	✗
Concurrent SAN & NAS	✓
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	12
Storage Networking Ports *MAX*	16
Ethernet Ports 1 / 10 Gb *MAX*	16 / 8
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	6
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	7
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✗ / ✓
Performance Monitoring Granularities *TOTAL #*	5
Notification and Logging *TOTAL #*	5

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✓
RHEV / VMware	✓ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✓ / ✓
Reserve Space / Extended Statistics	✓ / ✓
VASA / VADP	✗ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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Tegile T3200

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
101.67	31.87	33.42	16.05	12.38	7.95
EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	GOOD

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	2
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	2
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	6
SSD Optimization Methods *TOTAL #*	5
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	2 TB
Raw Storage Capacity *MAX*	180 TB
Raw Storage Density per Rack Unit *MAX*	14.9 TB/U
Self-healing Technologies *TOTAL #*	1
DRAM Cache *MAX, 2 CONTROLLERS*	192 GB
CPU Cores *MAX, 2 CONTROLLERS*	24
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	5
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✓
Scale-out	✗
Concurrent SAN & NAS	✓
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	12
Storage Networking Ports *MAX*	16
Ethernet Ports 1 / 10 Gb *MAX*	16 / 8
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	6
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	7
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✗ / ✓
Performance Monitoring Granularities *TOTAL #*	5
Notification and Logging *TOTAL #*	5

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✓
RHEV / VMware	✓ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✓ / ✓
Reserve Space / Extended Statistics	✓ / ✓
VASA / VADP	✗ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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Tegile T3300

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
101.48	31.87	33.23	16.05	12.38	7.95
EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	GOOD

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	2
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	2
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	6
SSD Optimization Methods *TOTAL #*	5
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	1.5 TB
Raw Storage Capacity *MAX*	162 TB
Raw Storage Density per Rack Unit *MAX*	14.6 TB/U
Self-healing Technologies *TOTAL #*	1
DRAM Cache *MAX, 2 CONTROLLERS*	192 GB
CPU Cores *MAX, 2 CONTROLLERS*	24
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	5
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✓
Scale-out	✗
Concurrent SAN & NAS	✓
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	12
Storage Networking Ports *MAX*	16
Ethernet Ports 1 / 10 Gb *MAX*	16 / 8
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	6
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	7
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✗ / ✓
Performance Monitoring Granularities *TOTAL #*	5
Notification and Logging *TOTAL #*	5

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✓
RHEV / VMware	✓ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✓ / ✓
Reserve Space / Extended Statistics	✓ / ✓
VASA / VADP	✗ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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Tegile T3400

Approximate Starting List Price: N/A

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
106.44	31.87	38.19	16.05	12.38	7.95
BEST-IN-CLASS	EXCELLENT	RECOMMENDED	EXCELLENT	EXCELLENT	GOOD

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✓
Synchronous Replication	✗
Snapshot Methods *TOTAL #*	2
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✓ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✓ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✓ / ✓
SSD / HDD	✓ / ✓
Automated/Policy-based Provisioning *TOTAL #*	2
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✓
Tiering/Caching Management Level *PER VM / PER LUN*	✓ / ✓
QoS Options *TOTAL #*	2
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	6
SSD Optimization Methods *TOTAL #*	5
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	90 Days

HARDWARE

Raw SSD-only Storage Capacity *MAX*	314 TB
Raw Storage Capacity *MAX*	314 TB
Raw Storage Density per Rack Unit *MAX*	31.4 TB/U
Self-healing Technologies *TOTAL #*	1
DRAM Cache *MAX, 2 CONTROLLERS*	192 GB
CPU Cores *MAX, 2 CONTROLLERS*	32
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	5
Read / Write	✓ / ✓
Write Journaling / Block IO Acceleration	✓ / ✓
NAS Acceleration	✓
Scale-out	✗
Concurrent SAN & NAS	✓
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	12
Storage Networking Ports *MAX*	16
Ethernet Ports 1 / 10 Gb *MAX*	16 / 8
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	6
Controller Addition / Replacement	✓ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✓

MANAGEMENT

Feature License Included *TOTAL #*	6
AST / Performance Monitoring	✓ / ✓
Replication / Snapshots	✓ / ✓
Application-aware Snapshots / Thin Provisioning	✓ / ✓
Management Methods *TOTAL #*	7
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✗ / ✓
Performance Monitoring Granularities *TOTAL #*	5
Notification and Logging *TOTAL #*	5

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✓
RHEV / VMware	✓ / ✓
Microsoft ODX	✓
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✓ / ✓
Reserve Space / Extended Statistics	✓ / ✓
VASA / VADP	✗ / ✗
AQDT / SIOC	✗ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✓

✓ Supported ✗ Unsupported

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X-IO Technologies
ISE 710 G3 Hybrid Storage Array

Approximate Starting List Price: $99,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
59.05	11.25	19.37	10.60	8.38	9.45
BASIC	BASIC	BASIC	BASIC	BASIC	BEST-IN-CLASS

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✗
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	1
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✗
Automated/Policy-based Provisioning *TOTAL #*	6
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	4
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	5 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	2 TB
Raw Storage Capacity *MAX*	11 TB
Raw Storage Density per Rack Unit *MAX*	15.5 TB/U
Self-healing Technologies *TOTAL #*	4
DRAM Cache *MAX, 2 CONTROLLERS*	32 GB
CPU Cores *MAX, 2 CONTROLLERS*	12
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	1
Read / Write	✗ / ✗
Write Journaling / Block IO Acceleration	✗ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	✗ / 4
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	5
Controller Addition / Replacement	✗ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✗

MANAGEMENT

Feature License Included *TOTAL #*	3
AST / Performance Monitoring	✗ / ✓
Replication / Snapshots	✗ / ✓
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	9
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	6

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✓ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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X-IO Technologies
ISE 720 G3 Hybrid Storage Array

Approximate Starting List Price: $109,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
59.06	11.25	19.38	10.60	8.38	9.45
BASIC	BASIC	BASIC	BASIC	BASIC	BEST-IN-CLASS

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✗
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	1
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✗
Automated/Policy-based Provisioning *TOTAL #*	6
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	4
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	5 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	2 TB
Raw Storage Capacity *MAX*	20 TB
Raw Storage Density per Rack Unit *MAX*	15.5 TB/U
Self-healing Technologies *TOTAL #*	4
DRAM Cache *MAX, 2 CONTROLLERS*	32 GB
CPU Cores *MAX, 2 CONTROLLERS*	12
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	1
Read / Write	✗ / ✗
Write Journaling / Block IO Acceleration	✗ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	✗ / 4
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	5
Controller Addition / Replacement	✗ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✗

MANAGEMENT

Feature License Included *TOTAL #*	3
AST / Performance Monitoring	✗ / ✓
Replication / Snapshots	✗ / ✓
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	9
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	6

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✓ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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X-IO Technologies
ISE 730 G3 Hybrid Storage Array

Approximate Starting List Price: $119,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
59.16	11.25	19.48	10.60	8.38	9.45
BASIC	BASIC	BASIC	BASIC	BASIC	BEST-IN-CLASS

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✗
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	1
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✗
Automated/Policy-based Provisioning *TOTAL #*	6
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	4
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	5 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	2 TB
Raw Storage Capacity *MAX*	29 TB
Raw Storage Density per Rack Unit *MAX*	15.5 TB/U
Self-healing Technologies *TOTAL #*	4
DRAM Cache *MAX, 2 CONTROLLERS*	32 GB
CPU Cores *MAX, 2 CONTROLLERS*	12
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	1
Read / Write	✗ / ✗
Write Journaling / Block IO Acceleration	✗ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	✗ / 4
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	5
Controller Addition / Replacement	✗ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✗

MANAGEMENT

Feature License Included *TOTAL #*	3
AST / Performance Monitoring	✗ / ✓
Replication / Snapshots	✗ / ✓
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	9
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	6

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✓ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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X-IO Technologies
ISE 740 G3 Hybrid Storage Array

Approximate Starting List Price: $127,000

DCIG Scores and Rankings

OVERALL SCORE	Software	Hardware	Management	Virtualization	Support
59.47	11.25	19.79	10.60	8.38	9.45
BASIC	BASIC	BASIC	BASIC	BASIC	BEST-IN-CLASS

SOFTWARE

Asynchronous Replication *CONTINUOUS / PERIODIC*	✗ / ✗
Synchronous Replication	✓
Snapshot Methods *TOTAL #*	1
Storage Capacity Optimization Methods	
Thin Provisioning / Eager Zero Thick	✓ / ✓
Storage Reclamation *NATIVE / 3RD PARTY*	✓ / ✗
Block Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
File Level Deduplication *INLINE / POST-PROCESS*	✗ / ✗
Compression *INLINE / POST-PROCESS*	✗ / ✗
Deduplicated / Compressed Data Stores	
DRAM Cache / NVRAM Cache	✗ / ✗
SSD / HDD	✗ / ✗
Automated/Policy-based Provisioning *TOTAL #*	6
Automated Storage Tiering *SCHEDULED / DYNAMIC*	✗ / ✓
Dynamic Data Placement *PRESET / USER-DEFINED*	✓ / ✗
Tiering/Caching Management Level *PER VM / PER LUN*	✗ / ✓
QoS Options *TOTAL #*	4
Data Migration to Cloud	✗
Network File Systems *TOTAL #*	✗
SSD Optimization Methods *TOTAL #*	2
Encryption *ARRAY-BASED / SELF-ENCRYPTING DRIVES*	✗ / ✓

SUPPORT

Contract Support Methods *TOTAL #*	10
Remote Monitoring / Proactive Remediation	✓ / ✓
Hardware Warranty	5 Years

HARDWARE

Raw SSD-only Storage Capacity *MAX*	2 TB
Raw Storage Capacity *MAX*	38 TB
Raw Storage Density per Rack Unit *MAX*	15.5 TB/U
Self-healing Technologies *TOTAL #*	4
DRAM Cache *MAX, 2 CONTROLLERS*	32 GB
CPU Cores *MAX, 2 CONTROLLERS*	12
Controller Config *ACTIVE-ACTIVE / DUAL-ACTIVE*	✓ / ✗
Flash-based Caching *TOTAL #*	1
Read / Write	✗ / ✗
Write Journaling / Block IO Acceleration	✗ / ✓
NAS Acceleration	✗
Scale-out	✗
Concurrent SAN & NAS	✗
FC / iSCSI	✓ / ✓
Redundant/Hot-swap Components *TOTAL #*	10
Storage Networking Ports *MAX*	8
Ethernet Ports 1 / 10 Gb *MAX*	✗ / 4
FC Ports 8 / 16 Gb *MAX*	8 / ✗
Non-disruptive Operations *TOTAL #*	5
Controller Addition / Replacement	✗ / ✓
Controller Code Upgrades	✓
Storage Shelf or Node Addition	✗

MANAGEMENT

Feature License Included *TOTAL #*	3
AST / Performance Monitoring	✗ / ✓
Replication / Snapshots	✗ / ✓
Application-aware Snapshots / Thin Provisioning	✗ / ✓
Management Methods *TOTAL #*	9
vSphere / SCVMM	✓ / ✓
OpenStack / SMI-S	✓ / ✗
Performance Monitoring Granularities *TOTAL #*	7
Notification and Logging *TOTAL #*	6

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM	✓ / ✗
RHEV / VMware	✓ / ✓
Microsoft ODX	✗
VMware VAAI	
Full Copy / Block Zeroing	✓ / ✓
HAL / Dead Space Reclamation	✓ / ✓
Full File Clone / Out-of-space	✗ / ✗
Reserve Space / Extended Statistics	✗ / ✗
VASA / VADP	✓ / ✗
AQDT / SIOC	✓ / ✓
VASRM / PSA	✗ / ✗
Storage DRS / ALUA	✓ / ✗

✓ Supported ✗ Unsupported

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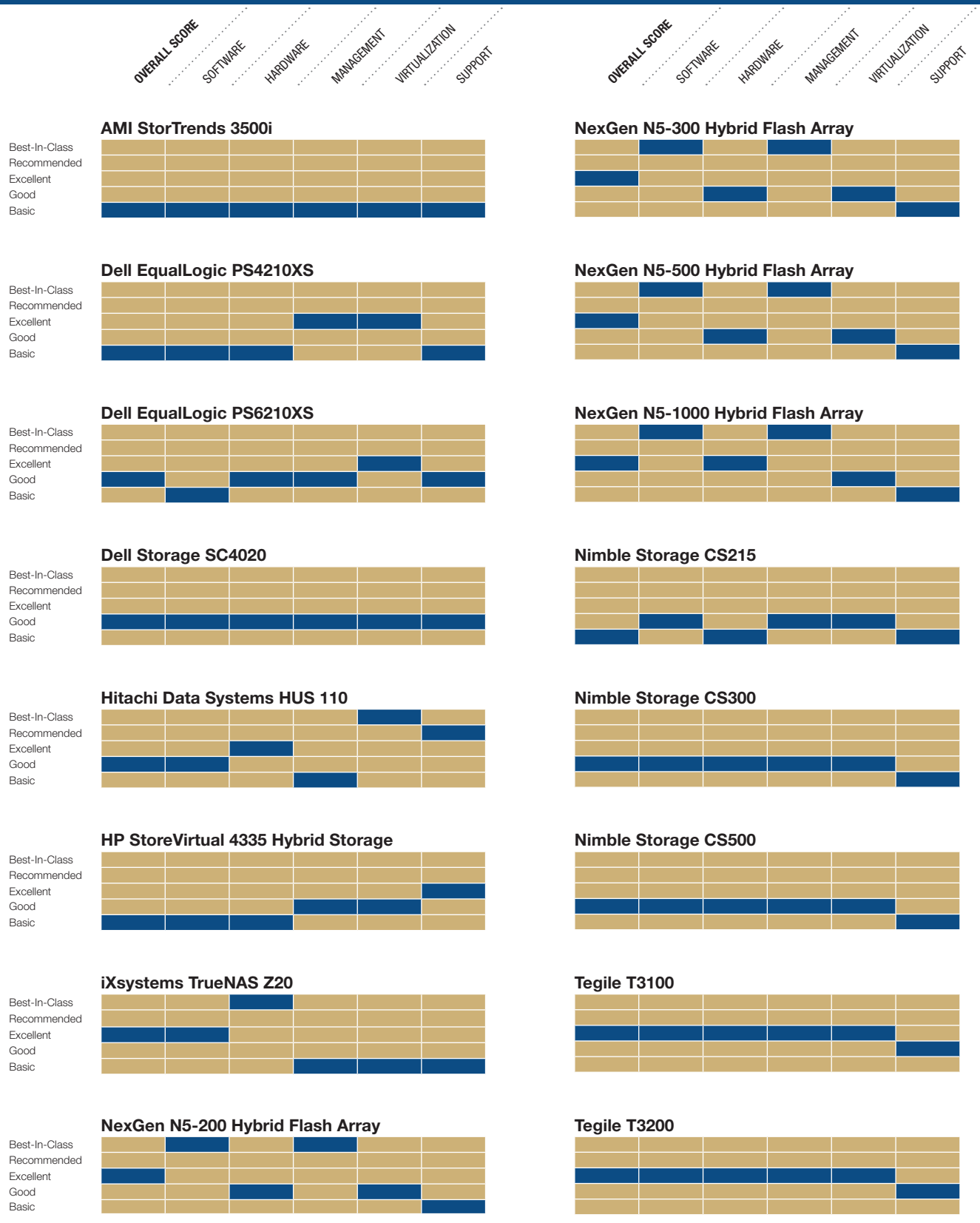
Product Rankings Dashboard



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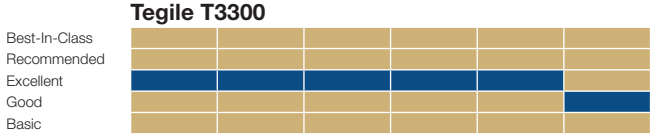
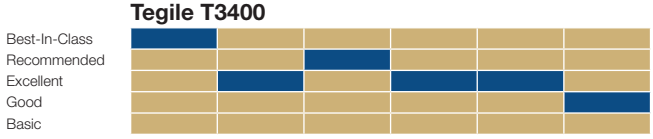
Product Rankings Dashboard (continued)

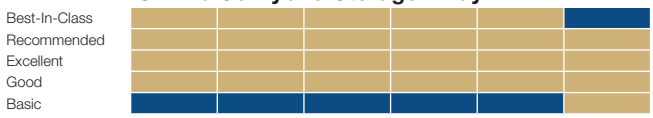
Tegile T3300



Tegile T3400

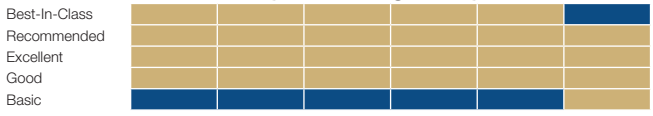


X-IO Technologies ISE 710 G3 Hybrid Storage Array



X-IO Technologies ISE 720 G3 Hybrid Storage Array

X-IO Technologies ISE 730 G3 Hybrid Storage Array



X-IO Technologies ISE 740 G3 Hybrid Storage Array

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APPENDICES

Appendix A: Definitions, Explanations and Terminology

Appendix B: Storage Provider Contact Information

Appendix C: Author Contact Information

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Definitions, Explanations and Terminology

This section contains brief definitions and/or explanations of the terms used and assumptions made when developing the data sheets found in the *DCIG 2015-16 SME Hybrid Storage Array Buyer's Guide.* These terms are in the same order as they appear on the individual data sheets.

SOFTWARE

Asynchronous Replication

Indicates if the array can asynchronously replicate data to another hybrid storage array from the same storage provider. Asynchronous replication may be continuous or periodic.

Continuous: Every write I/O is copied, stored in a local disk cache and then replicated as soon as possible to a secondary array.

Periodic: A snapshot of one or more volumes is periodically taken and then replicated to a secondary array.

Synchronous Replication

Indicates if the array can synchronously replicate data to another array from the same storage provider. Write I/Os need to be received at the primary or source array and then copied and written to the secondary, or target array, with the write confirmed as complete by both before processing can continue.

Snapshot Methods *(Total #)*

Indicates the total number of snapshots methods supported by the array. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Storage Capacity Optimization Methods

Thin Provisioning

A storage optimization method where volume resources are allocated on the disk only when needed.

Eager Zero Thick

A storage optimization method used primarily in virtualized environments where volume resources are pre-allocated on the disk and the space then filled with zeros. This is done to indicate the space is unused and may be reclaimed as well as a method to overwrite data on storage space that was previously used by another virtual machine.

Storage Reclamation *(Native / 3rd Party)*

Storage reclamation returns de-provisioned storage to the pool of available capacity.

Native: indicates that this capability is supported natively by the array without the aid of 3rd party software.

3rd Party: indicates if the array is recognized by third party software, such as Symantec Storage Foundation, that can reclaim freed blocks of its thinly provisioned storage.

Block Level Deduplication *(Inline / Post-process)*

Deduplication saves space by storing a pointer to an existing identical block rather than storing a second instance of the data.

Inline: Inline means that data is deduplicated before it is stored.

Post-process: Post-process means that data is first stored in its native or raw format and subsequently deduplicated, generally during off-peak hours.

File Level Deduplication *(Inline / Post-process)*

Deduplication saves space by storing a pointer to an existing identical file rather than storing a second instance of the data.

Inline: Inline means that data is deduplicated before it is stored.

Post-process: Post-process means that data is first stored in its native or raw format and subsequently deduplicated, generally during off-peak hours.

Compression *(Inline / Post-process)*

Compression is a feature that compresses data as it is written to storage systems.

Inline: Data is compressed before it is stored to disk.

Post-process: Data is first stored to disk in its native or raw format and subsequently compressed, generally during off-peak hours.

Deduplicated / Compressed Data Stores

DRAM Cache / NVRAM Cache

Indicates if the array supports deduplication and/or compression on the particular data store.

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Appendix A—Definitions, Explanations and Terminology (continued)

SSD / HDD
Indicates if the array supports deduplication and/or compression on the particular data store.

Automated/Policy-based Provisioning *(Total #)*
The ability to provision storage options by using pre-defined policies that are carried out automatically without requiring manual intervention. Indicates the number of policies supported. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Automated Storage Tiering *(Scheduled / Dynamic)*
Automated storage tiering places data on the appropriate tier of storage *(HDD, SSD, Flash memory, etc)* within the array based upon policies that are either built into the storage array, set by the storage administrator, or some combination of both. Moving data between tiers may occur at pre-scheduled times or dynamically.

Scheduled: Indicates that tiering occurs at pre-scheduled times.

Dynamic: Indicates that the array monitors and adjusts tiering in real-time or near real-time.

Dynamic Data Placement *(Preset / User-defined)*
Indicates whether Dynamic Automated Storage Tiering algorithms operate.

Preset: Data is moved/placed dynamically (in real time) based on preset system policies/algorithms.

User-defined: Data is moved/placed dynamically (in real time) based on user-defined policies

Tiering/Caching Management Level
Indicates if the array offers management of storage tiering/caching at the Virtual Machine or LUN level.

Per VM: Indicates that the array supports automated tiering per VM.

Per LUN: Indicates that the array supports automated tiering per LUN.

QoS Options *(Total #)*
A count of the workload prioritization methods supported by the array. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Data Migration to Cloud
Indicates the array's ability to natively attach, integrate and/or migrate data to public or private cloud storage providers.

Network File Systems *(Total #)*
A network file system is a protocol that allows the "mounting" of devices or file systems on other systems over a network. Indicates the total number of network file systems supported by the array. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

SSD Optimization Methods *(Total #)*
Indicates the total number of specialized SSD optimization techniques supported by the array. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Encryption *(Array-based / Self-Encrypting Drives)*
Indicates if model support data encryption, and whether encryption is array-based encryption or through the use of self-encrypting drives.

SUPPORT

Contract Support Methods *(Total #)*
Indicates the number of contract support options available. Methods of support may include phone, email, web chat, remote monitoring, and more. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Remote Monitoring / Proactive Remediation
Indicates whether the vendor offers remote monitoring of the storage system and/or proactive resolution of problems discovered through remote monitoring and/or performance and fault data that has been automatically uploaded to the vendor.

Hardware Warranty
Indicates the length of standard warranty that is included with the array at no extra cost.

HARDWARE

Raw SSD-only Storage Capacity *(Max)*
Indicates the maximum amount of raw flash memory storage capacity in terabytes *(TBs)* supported by the

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array. This number only includes the array's footprint and not the storage capacity of other systems it may have virtualized.

Raw Storage Capacity *(Max)*

Indicates the maximum amount of raw storage capacity in terabytes *(TB)* natively supported by the array.

Raw Storage Density per Rack Unit *(Max)*

Indicates the maximum amount of raw storage density in terabytes per rack unit *(TB/U)* natively supported by the array.

Self-healing Technologies *(Total #)*

Indicates the total number of technologies which may repair failures without administrator intervention. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

DRAM Cache *(Max, 2 Controllers)*

Indicates the maximum number of gigabytes *(GBs)* of DRAM cache the model supports in a two controller configuration.

CPU Cores *(Max, 2 Controllers)*

Indicates the maximum number of central processing unit *(CPU)* cores the model supports in a two controller configuration.

Controller Config *(Active-Active / Dual-Active)*

Indicates the type of controller configurations the array offers.

Active-Active: Two controllers are configured with multipathing software and have concurrent access to the disk drives that are then presented as LUNs to attached hosts. In the event a controller fails or is taken offline, attached host(s) may detect little or no interruption in service as the other controller takes over for the failed unit though a drop in performance may occur. This is considered an enterprise class feature.

Dual Active: Both controllers are active and have concurrent access to the disk drives that are presented as LUNs to the attached hosts. The difference from Active-Active is that half of the array's LUNs are assigned to and controlled by one controller, and the other half of the LUNs to the other, so a LUN can only be accessed down one path through one controller at a time. If a controller should be taken offline or fail, the other controller assumes control for its LUNs.

Flash-based Caching *(Total #)*

Indicates the array's ability to utilize flash memory as cache in front of permanent storage to improve system performance.

Read: Indicates whether the array utilizes flash memory for read caching.

Write: Indicates whether the array utilizes flash memory for write caching.

Write Journaling: Write journaling uses a circular journal to provide write caching and reliability assurance before writing to permanent storage.

Block IO Acceleration: Block IO acceleration uses caching specifically for block *(SAN)* performance beyond read/write operations such as metadata storage.

NAS Acceleration: The use of caching specifically for NAS performance beyond read/write operations such as metadata storage.

Scale-out

Indicates support for scale-out architecture.

Concurrent SAN & NAS

Indicates the ability for the storage array to communicate with applications using both block *(SAN)* and network file system *(NAS)* clients at the same time.

FC / iSCSI

Indicates the ability for the storage array to support Fibre Channel or iSCSI protocols. Fibre Channel *(FC)* is used as a networking protocol to transmit data between computer devices, such as a server and a storage device. Internet Small Computer System Interface *(iSCSI)* is a block-based protocol for running SCSI commands over Internet Protocol *(IP)* on Ethernet to access storage resources.

Redundant / Hot-swap Components *(Total #)*

Indicates the total number of redundant or hot-swappable components. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Storage Networking Ports *(Max)*

Indicates the maximum number of storage networking interfaces supported by the array regardless of the type of port.

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Appendix A—Definitions, Explanations and Terminology (continued)

Ethernet Ports 1 / 10 Gb (Max): Indicates the maximum number of 1 and/or 10 Gb Ethernet storage networking ports supported by the array in any configuration.

FC Ports 8 / 16 Gb (Max): Indicates the maximum number of 8 Gb and 16 Gb Fibre Channel storage networking ports supported by the array in any configuration.

Non-disruptive Operations *(Total #)*

Non-disruptive operations allow hardware and software to operate without service interruptions. The number indicates the total non-disruptive options supported. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Controller Addition: The native array capability to add a controller without disrupting the availability of the storage system.

Controller Replacement: The native array capability replace a controller without disrupting the availability of the storage system.

Controller Code Upgrades: The native array capability to upgrade controller code without disrupting the availability of the storage system.

Storage Shelf or Node Addition: The native array capability to add storage shelves or nodes without disrupting the availability of the storage system.

MANAGEMENT

Feature License Included *(Total #)*

Indicates the total number of licenses that are bundled with the array when purchased *(included without an extra licensing fee.)*

AST / Performance Monitoring: Indicates if AST and/or performance monitoring licenses are included in the purchase of the array.

Replication / Snapshots: Indicates if replication and/or snapshot licenses are included in the purchase of the array.

Application-aware Snapshots / Thin Provisioning: Indicates if application-aware snapshots and/or thin provisioning licenses are included in the purchase of the array.

Management Methods *(Total #)*

Indicates the total number of management methods supported. Management methods include console access, command line *(SSH, Telnet),* web interfaces, etc. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

vSphere / SCVMM: Indicates whether the array can be managed from within the VMware vSphere and/or Microsoft System Center Virtual Machine Manager *(SCVMM)* management consoles.

OpenStack / SMI-S: Indicates whether the array can be managed via OpenStack and/or Storage Management Initiative Specification *(SMI-S).*

Performance Monitoring Granularities *(Total #)*

Indicates the total number of levels that the array provides performance monitoring and reporting *(system-wide, per VM, per LUN, etc).*The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

Notification and Logging *(Total #)*

Indicates the total number of methods and protocols available for logging errors and sending system notifications. The specific elements supported for each product are available by accessing the DCIG Analysis Portal.

VIRTUALIZATION

Microsoft Hyper-V / Oracle VM

Indicates the array is certified to support Microsoft Hyper-V and/or Oracle VM.

RHEV / VMware

Indicates the array is certified to support Red Hat Enterprise Virtualization and/or VMware.

Microsoft ODX

The array supports Microsoft ODX *(offloaded data transfer),* a technology which enables direct data transfers within or between storage devices, avoiding the need to send data back and forth to a host.

VMware VAAI

VAAI is a group of proprietary application programming interfaces *(APIs)* provided by VMWare's vSphere platform which allows certain I/O tasks to be offloaded to array hardware. VAAI first appeared in vSphere 4.1 and was expanded in 5.0.

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Appendix A—Definitions, Explanations and Terminology (continued)

Full Copy: Full copy is used to copy data and/or create clones, avoiding the need to send data back and forth to a host.

Block Zeroing: Block zeroing enables the storage array to zero out a large number of data blocks to speed the provisioning of virtual machines and reduce input/output overhead.

HAL: Hardware Assisted Locking *(HAL)* allows the offload of SCSI commands from the ESX server to the storage array so it can control the locking mechanism while the storage array updates data.

Dead Space Reclamation: With Dead Space Reclamation, using the SCSI UNMAP command, an ESXi host can inform a storage array that space may be reclaimed that previously had been occupied by a VM that has since been migrated to another datastore or deleted.

Full File Clone: The Full File Clone command instructs the storage array to clone a virtual disk. This is a network-attached storage *(NAS)* hardware acceleration primitive.

Out-of-space: The Out-of-space command *(a.k.a. Thin Provisioning Stun*) is part of VAAI 5.0 and was introduced to mitigate the impact on virtual machines *(VMs)* when thin-provisioned datastores reach 100 percent of capacity. The array alerts the VMware vSphere ESX host and/or vCenter when specified thresholds are reached. Should a datastore reach 100 percent of capacity, only those VMs requiring additional capacity are paused while VMs needing no additional capacity continue to run.

Reserve Space: Reserve Space enables the creation of thick virtual machine disk *(VMDK)* files on network-attached storage *(NAS)* datastores, allowing administrators to reserve the space required even when the datastore is network-attached storage.

Extended Statistics: Extended Statistics enables vSphere functionality to display actual space usage statistics on network-attached storage *(NAS)* datastores without the use of third-party tools. Before the introduction of Extended Statistics, it would have been necessary to use array-based tools to monitor the space being used on a thinly provisioned virtual disk machine *(VMDK)* on a back-end data store.

VASA

vSphere Storage APIs for Storage Awareness *(VASA)* is a set of APIs that permit storage products to integrate with vCenter for management functionality. Storage Awareness collects configuration, capability and storage health information from storage products, allowing the administrator to build storage profiles based on capabilities.

VADP

vStorage Application Programming Interface for Data Protection *(VADP)* is a data protection framework introduced in vSphere 4.0. VADP—which enables centralized, off-host LAN-free backup of vSphere virtual machines—reduces ESX host resources during backup processing, and enables flexible backup windows.

AQDT

VMware ESX 3.5 Update 4 introduced an adaptive queue depth throttling *(AQDT)* algorithm that adjusts the LUN queue depth in the VMkernel I/O stack. This algorithm is activated when the storage array indicates LUN I/O congestion by returning a BUSY or QUEUE FULL status. When LUN congestion is detected, VMkernel throttles the LUN queue depth. The VMkernel attempts to gradually restore the LUN queue depth when LUN congestion conditions subside. AQDT prevents the array from being flooded with LUN I/O requests and enables the array to recover to a normal operational state. ***NOTE: This is not applicable for NFS mounted storage.***

SIOC

Storage I/O Control *(SIOC)* for VMware is a dynamic control mechanism for proportional allocation of shared storage resources to virtual machines running on multiple hosts.

VASRM

vStorage APIs for Site Recover Manager *(VASRM)* offers remote replication features enabling a device to failover to a recovery site.

PSA

To manage storage multipathing, ESX/ESXi uses a special VMkernel layer: Pluggable Storage Architecture *(PSA).* The PSA is an open modular framework that coordinates the simultaneous operation of multiple multipathing plugins *(MPPs).* PSA is a collection of

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VMkernel APIs that allow third party hardware vendors to insert code directly into the ESX storage I/O path. This allows 3rd party software developers to design their own load balancing techniques and failover mechanisms for particular storage array. The PSA coordinates the operation of the NMP and any additional 3rd party MPP. ***(Source: http://kb.vmware.com/ selfservice/microsites/search.do?language=en_US&cmd= displayKC&externalId=1011375)***

Storage DRS

Storage Distributed Resource Scheduler *(DRS)* provides virtual machine placement and load balancing mechanisms based on I/O and space capacity.

ALUA

Asymmetrical Logical Unit Access *(ALUA)* is used to determine the optimal path for asymmetrical arrays.

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Website: www.dell.com

Hewlett-Packard Corporation
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