



# White Paper

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## Driving Business Value from Flash- optimized Storage

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## Flash: Old(ish), New, and Definitely Evolving

Solid-state flash storage is one of today's most important "old yet new" IT technologies. It's *old* in the sense that some form of solid-state memory has been around since the 1970s. Flash technology arose in the 1980s, and modern flash drives within enterprise storage subsystems arrived on the market back in early 2008, with various types of flash-card packaging being the latest turn of the technology crank.

Flash storage is *new* because the ongoing advances in performance, density, and other factors are still continuing to help flash take over an increasing number of performance-sensitive workloads from conventional spinning-disk arrays.

The culmination of decades of development has brought flash to today's storage controllers, cache components, and application-specific appliances. And the imminent market traction growth for the technology looks very positive. Dozens of flash-focused arrays are now available, and more improvements are on the way. Excitement over flash is well-founded because of the performance gains for databases, virtual server environments, and virtual desktop infrastructures (VDIs).

[NetApp](#), a storage vendor that has now amassed many years of experience going to market with flash-based offerings, appears to understand this fact. The company has committed to its customers and prospects that it will focus its flash development in ways most likely to support *tangible business-level value*. The effort centers on NetApp closely tying its product development and portfolio to match its customers' real-world application needs; the result being a range of all-flash solutions that support needs ranging from brute horsepower to data-management-rich sophistication. NetApp has a full portfolio of products suited to the workload requirements of its customers.

### Value in Surprising Ways

Although the march of technology is helping flash to add value to well-understood user needs and challenges—such as improved application performance, lower power consumption and, increasingly, easy deployment—there are also entirely new ways in which flash can bring value to users:

- **Counterintuitive twists in the infrastructure conundrum.** Some are counterintuitive twists in the infrastructure conundrum. For example, spending relatively more (per GB) on some flash *can actually drive down the overall per-GB cost for an organization*. This is because (1) higher utilization levels can be achieved, and (2) higher-capacity/less-expensive media can be employed elsewhere in the infrastructure when active, low-latency/high-bandwidth I/O is served from flash.
- **Previously unattainable benefits.** Chief among these is the ability to dramatically reduce software licensing costs: Flash allows more work (I/O volume and speed) to be done on fewer cores, reducing the number of cores needed and therefore precluding large amounts of (otherwise inevitable) server and licensing "sprawl." Some specific example numbers are detailed later in this paper.

NetApp has undertaken a very pragmatic, business-focused re-examination of which flash storage works best for which business outcomes. It is focused on optimizing flash deployment technologies to achieve what organizations need, and it is guiding its efforts via a program called "FlashEssentials."

### SOMETHING OLD BECOMES SOMETHING NEW

After conducting extensive internal testing, NetApp says its clustered DATA ONTAP and SANtricity operating systems are now optimized for flash.

Clustered DATA ONTAP offers FlashEssentials, including both read and write optimizations, in-line efficiencies from advanced development work, and software-defined access to flash ... all important benefits to flash arrays.

SANtricity brings sub-millisecond response times to the well-known and cost-effective E-series platform—delivering enterprise reliability and low cost per IOPS.

This approach marries the performance of flash technology with the rich set of software services, interoperability, and support that customers expect from a storage vendor. NetApp is pragmatically focusing its efforts on optimizing its existing platforms to drive, and derive, business value from flash.

This “business-first, technology-second” approach is something NetApp can promote—but most “single-hammer” vendors cannot—because NetApp offers a portfolio of flash options. Indeed, after user needs are viewed through the pragmatic FlashEssentials lens, much of the received-wisdom assumption about flash is revealed not to be the “given” that it is all-too-often seen to be.

## Managing Flash Assumptions

Flash has broad value and this is clearly one of today’s information technology darlings. But with improvements and growth come tradeoffs. For instance, higher data density can be linked with lower media longevity, although that impacts can be mitigated by such things as error correction and overprovisioning of capacity (although, of course, overprovisioning increases cost).

Additionally, several common assumptions about flash are invalid. For example:

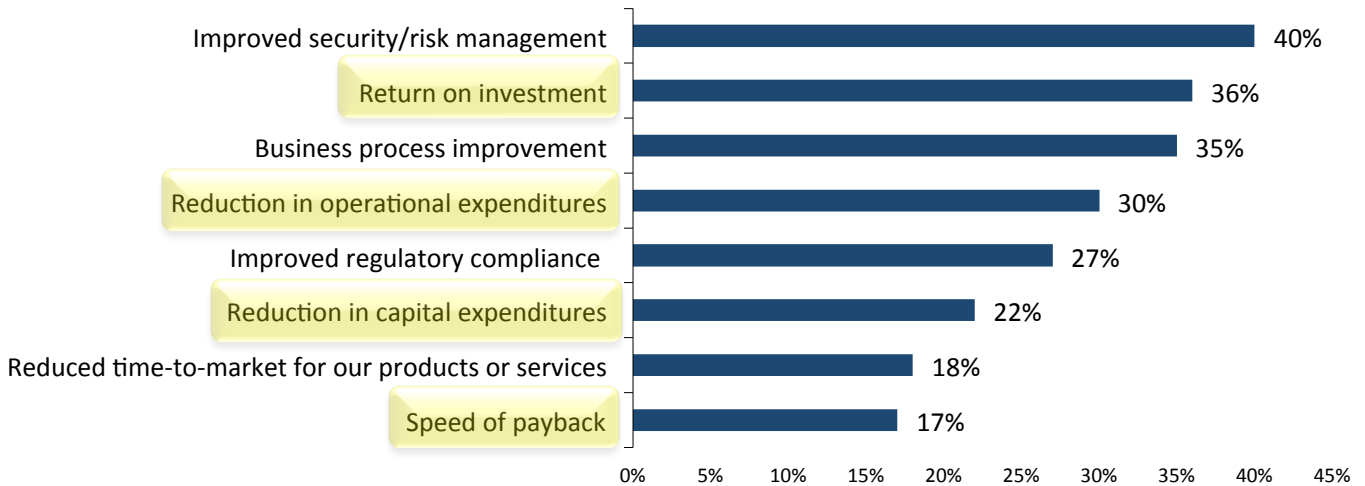
- **“Flash is expensive.”** This assumption applies to flash media when viewed in terms of cost for capacity. But with orders of magnitude more performance than hard disk drives, flash is cheaper than disk by any performance metric. Additionally, flash storage can save on server costs. With increasingly powerful multi-core server processors now available, IT managers may be inclined to try boosting application performance by upgrading to newer processors. But when they install more cores, the result is that per-core utilization goes down. That’s because the real speed bottleneck is in the storage. IT professionals may actually compound the problem by adding more flash storage *while ignoring the more subtle need for a better I/O strategy*. The result: Performance still flags because the upgrades were performed in a vacuum, so to speak.
- **“Existing architectures are not well-suited for flash.”** Assuming that an optimal product architecture is a new product architecture, some flash storage vendors are designing all-flash and hybrid-flash arrays from scratch. But the assumption that only new product architectures can support flash’s benefits is not universally valid—and NetApp’s offerings serve as proof. The NetApp clustered Data ONTAP architecture, for example, is uniquely suited for flash performance and endurance characteristics. It deploys a “write-anywhere” approach that acts as a natural wear leveler. Write I/Os have always been coalesced and parallelized, which increases performance and reduces media wear. The NetApp SANtricity architecture is similarly well-suited to flash with a design that offers consistent, low-latency performance by eliminating storage services that can interfere with performance. These services are provided using host-based solutions for many performance database environments.
- **“One size fits all.”** Many of the “single-hammer” vendors would have customers believe that a single solution is ideal for every flash requirement. However, the ideal solution characteristics vary based on workload and customer needs. For some workloads, nothing is more important than achieving the lowest possible latency for every transaction, while other workloads see more benefit from data reduction, data management (including cloning), and integrated data protection technologies for backup and disaster recovery.
- **“With flash, TCO is the be-all and end-all of business value.”** A low total cost of ownership is good. But attaining a high return on investment is even better. A high ROI reflects a more holistic appreciation of an IT infrastructure’s true value to a business. It may cost less to buy and deploy a given flash array, but if that array provides inconsistent, unpredictable performance, then the organization may end up losing productivity, revenue, or even customers. A great return on investment is one of the best markers of a successful technology deployment. And, as Figure 1<sup>1</sup> shows, ROI and similar cost-centric considerations were identified by survey respondents as important criteria for savvy IT decision makers who are evaluating which technology investments they should pursue.

<sup>1</sup> Source: ESG Research Report, [2015 IT Spending Intentions Survey](#), February 2015.

- **“Drivers love big engines.”** This assumption puts a fine point on the need for a flash array (or any IT gear) to deliver real business value beyond whatever impressive specs it may offer. Imagine a family driving a car to the beach. The car is a high-end Mercedes with a 400-horsepower engine. But the engine’s speed doesn’t matter as much as the real value that results—getting to the shore faster means they maximize the experience of a fun, memorable day with loved ones.

Figure 1. IT Investment Justifications in 2015

**Which of the following considerations do you believe will be most important in justifying IT investments to your organization’s business management team over the next 12 months? (Percent of respondents, N=601, three responses from each were accepted.)**



Source: Enterprise Strategy Group, 2015.

## NetApp and the Strength of a Well-tuned Portfolio

NetApp’s strategy is to deliver value to real-world business applications through regular enhancements to its two main flash-based storage architectures, the Data ONTAP-based All Flash FAS and the SANtricity-based EF-Series. All Flash FAS arrays are suited for shared-infrastructure applications such as virtual server and virtual desktop infrastructures. EF-Series arrays using the SANtricity storage operating system are optimized primarily for pure “pedal to the metal” database performance.

Here’s how the product families line up, with descriptions of the workloads and functions they are best suited for:

- **All Flash FAS:** Virtualized and shared environments often need highly efficient I/O to achieve maximum multi-user performance from a minimum number of physical servers housing VMs. The All Flash FAS provides data management features such as SAN and NAS support, integrated data protection, cloning, parallel I/O, in-line compression, and dedupe algorithms to add value to complex or hyper-converged infrastructures operating on top of a scale-out storage architecture.
- **EF-Series:** For financial processing, test/dev, and many demanding block-based database applications, NetApp’s numbers for its EF-Series show the product delivering consistent 500,000 IOPS performance with a less-than 300 microsecond response time, thanks to an extremely efficient direct data path and a performance-enhanced scale-up architecture. NetApp also promotes the EF-Series as being extremely rugged and dependable.

### GOOD BREEDING

A few of the DATA ONTAP data management services encapsulated in FlashEssentials include:

- Parallel I/O threading to handle multiple simultaneous requests.
- Specialized wear-limiting architecture.
- QoS to help ensure each workload gets the resources it needs
- In-line compression.
- Zero-block in-line deduplication.
- Ability to move data between flash, HDD, and cloud.

## Complementary Positioning

An example of EF-Series value might be a credit-card processing application achieving a consistent sub-millisecond response time even during the busiest times of year—without seeing any performance spikes or dips. Or it might be a real estate analysis firm able to maximize its customer service by processing reports and records 70% faster than before.

With the EF-Series now squarely targeted at performance-sensitive applications, NetApp has clearly grown out of whatever initial promotional-related hesitancy it might have exhibited about the series. For a time, it believed that in-line compression and dedupe were storage functions that no organization could do without, but it now appreciates that those services can actually get in the way of certain ultra-high-performance workloads by increasing latency and even leading to performance inconsistency. In contrast, All Flash FAS use cases tend to be more “general purpose,” emphasizing operational flexibility and functional sophistication (*see sidebar*).

Thus, the value of having a portfolio approach to flash is that NetApp can recommend its All Flash FAS arrays as a good choice for users and applications that require those sophisticated storage services—the All Flash FAS arrays are excellent at leveraging the enterprise-quality data management services of NetApp’s Data ONTAP operating system. The product also is compatible with the company’s rich portfolio of data protection software, including SnapVault, SnapMirror, and MetroCluster for continuous data availability. These features allow for cost-effective backup and DR of flash arrays, which is unmatched by point-products from startup vendors.

## Market Relevance: A Prescription for Value

The All Flash FAS and the EF-Series storage families are a reminder that all storage (flash, spinning disk, tape ... or a wooden file cabinet!) is just a cog in a much bigger data infrastructure machine. How such products function is up to the vendor of those products, but the vendor’s responsibility doesn’t end with a useful, practical design. How the products fit a customer’s need—how they add value—is the larger question. With its All Flash FAS and EF-Series, NetApp is showing that a storage architecture, whether created from scratch, built based on proven filesystem and operating system designs, or augmented with the latest cutting-edge flash-related breakthroughs, isn’t as important as the worth it delivers to businesses using it.

This is partly why NetApp is now focusing on refining its prescriptive product marketing efforts tied to its flash offerings. The company is aiming the high-performance EF-Series at performance-intensive database applications, and the All Flash FAS at workloads requiring leading-edge data management capabilities. It is also why NetApp is unveiling that overall positioning “wrapper” it calls FlashEssentials. Evidently, NetApp believes the role for its [FlashRay](#) platform is to incrementally drive flash adoption in the future by bringing down the cost of flash via more storage efficiency, and by simplifying the setup

### REAL-WORLD EXAMPLE: MANTRA GROUP

Mantra Group is a fast-growing hospitality organization based in Australia that manages well over 100 properties and more than 11,000 rooms. With continuing acquisitions and a growing need to optimize its online abilities (both traditional/internal efforts and to leverage sites such as Expedia and Priceline), Mantra’s central reservation system is its number-one mission-critical application. Mantra wanted more headroom to allow for dynamic, unpredictable needs and to maintain excellent response times externally while continuing to use a rich set of storage functions internally (e.g., snapshots to provide data protection and deduplication to help control costs). Such a mix of performance power (even during backup processing) and elegant, mature, sophisticated storage functionality was something Mantra felt was lacking in many other all-flash offerings.

Mantra moved its backend Microsoft SQL Server database to NetApp All Flash FAS and is now positioned to handle *up to 100% more business volume over the next three years* while delivering standout response times. As Garry Rich (Group General Manager IT, Mantra Group) says, “When connecting to a fire-hose the size of Expedia or Priceline, it can be hard to predict the real-time load on our systems. We receive more than 25,000 online hits daily, and we can’t allow response times to degrade. Having our reservation system on NetApp’s All Flash FAS ... makes us more competitive.”

*These comments are extracted and adapted for use in this paper from a full case study conducted by NetApp. This version of the content has been verified and approved by Mantra.*

and management of flash with a new UI designed to help channel customers reduce support costs.

### **Bringing Value to Software Licensing**

As an example of how a flash storage array can deliver business-level value, consider any company that is contemplating a database upgrade from SQL Server 2005 to SQL 2014 Enterprise Edition. Microsoft is transitioning from per-socket to per-core SQL licensing, and that move could drive up costs considerably if users don't make any other adjustments: A one-core SQL Server license carries a list price of about \$6,500. A server with two eight-core processors could mean that the licensing cost outlays could exceed \$100,000. And popular Oracle database license costs can be even higher than SQL costs are—\$27,000 per core is possible with Oracle.

Per-core licensing is a challenge because a large percentage of server-installed multi-core processors in business are underutilized: It is not hard to find many running at not much more than 20% CPU utilization because storage performance isn't keeping up with CPU performance. The "obvious" response is to add more flash to improve the performance. But that move can undermine cost-reduction efforts. A better response might be to consolidate databases by employing a more effective I/O scheme. That approach can boost CPU utilization to the point where the business might not need as many CPUs.

With close-to-full CPU utilization, a business may be able to cut its database server licensing costs dramatically—that is, by far more than just a small percentage improvement.

### **The Bigger Truth**

It's easy to become enamored with flash storage. It's fast, reliable, increasingly affordable, and growing more capable and flexible by the day. But flash can also exhibit a "darker" side when its benefits actually get in the way of optimal data management and business results. However, overall, the upside is attractive: Are your CPUs underutilized? Add more flash capacity. Is your database slow? Add flash.

Flash is a technology, not a market segment ... and it is certainly not necessarily an immediate solution for every problem. The key is to know how to put flash to use to deliver real business value. That means putting the right storage array into place to support the right application, and then using it correctly.

It is why NetApp, being pragmatic, has decided to focus on helping its customers and reseller partners understand which of its flash array families are best suited to which applications. That isn't an easy undertaking for any technology company. It's commendable that NetApp, which considers flash to be one of its core competencies, is making the effort.

It's also commendable that NetApp has decided to focus its own development efforts on what matters to its customers, and thus it is migrating technologies coming from its FlashRay development project over to its All Flash FAS and EF-Series product families.

Indeed, NetApp's efforts also serve to remind us that IT stands for "information technology," not "infrastructure technology," and each "hot new IT thing" still has to earn its way by adding value in a real business world.



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