



White Paper

## Reducing Total Cost of Ownership with Flash Storage

### Total Cost of Ownership of NetApp Flash Solutions Is Less Than That of Traditional Hard Disk Storage

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#### **Abstract**

This paper explores several of the total cost of ownership (TCO) benefits associated with flash storage compared to those of traditional hard disk storage environments. Experiences of customers with NetApp® flash storage solutions demonstrate how deployment of flash storage can translate into a lower TCO than that provided by traditional hard disks.

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# 1 Many Misconceptions

How do people typically respond when asked about implementing a flash solution to upgrade their storage environment? With a list of misperceptions regarding flash technology and price point.

Many of the most common assertions appear to make extremely valid points and, when taken together, can almost make a very compelling case against the use of flash technology in an enterprise storage environment:

- “Sure it’s fast, and I’ve heard great things about it, but flash solutions are also really expensive.”
- “My existing environment is fine. I can just add a couple more racks of SATA drives for not too much money, and that should get me through the next 12 months. Then next year we can add a few more racks if we need to and go from there. That’s the least expensive way to add capacity and how we’ve always responded when we’ve outgrown our existing environment.”
- “Flash sounds good, but I can’t afford to hire a new storage administrator who can manage both flash and hard disk drives. Even if we were to train our current administrators, on top of the time and expense, we’d still have to worry about a pretty long and steep learning curve that you get with any new technology; time and mistakes all cost money.”
- “I know that flash works great for consumer products, but isn’t it relatively untested in enterprise environments? My storage environment is a bit more advanced than your cellphone. Our customers need to know that we’re running a proven system that they can trust with their critical data and applications.”
- “We’ve sunk a lot of money into our data center, and we’ve got a pretty finely tuned mix of hard disks that is giving us a good balance between speed and cost. We don’t want to abandon this investment just because there is a newer, faster, and more expensive technology available.”
- “The last thing I want is someone trying to force a solution that they think is best into our environment just because it is the latest and greatest technology. This isn’t a one-size-fits-all kind of situation. You can’t go around trying to force a square peg into a round hole.”

In addition to a shared sentiment that flash solutions are not an appropriate technology for their enterprise storage environment, these quotes have one thing in common: *they’re wrong*.

When evaluating flash technologies as a component of an enterprise storage environment, CIOs and CTOs must take a longer term holistic view that focuses on the total cost of ownership (TCO) rather than exclusively on the hardware acquisition cost. This perspective, accounting not only for reduced future storage investments, but also for what the flash solution enables customers to do, will demonstrate the value of NetApp flash products over the long term and how they can drive a markedly lower TCO than an environment relying exclusively on spinning media.

The NetApp industry-leading portfolio of flash solutions consistently has been well received by its customers. Several of these customers were interviewed in order to capture an unbiased opinion of the solution supported by real-world examples that demonstrate how NetApp flash solutions drive a lower TCO while enhancing the speed with which these customers conduct business.

## 2 Flash Is Fast and Expensive, But Less Expensive Than HDDs?

Although the cost of flash storage solutions continues to fall, on a per-gigabyte capacity basis, it is still significantly more expensive to acquire than traditional hard drives. However, when the cost per gigabyte is examined in terms of TCO, and the customer looks past the pure acquisition cost and accounts for “soft factors” such as prolonging the life of a data center, lower operating costs (for example, power and cooling), increased flexibility and scalability, or the service levels that a flash solution enables, NetApp flash solutions become increasingly competitive with spinning media.

Because organizations are unique and have customized implementations of NetApp flash solutions, they will have different inputs that contribute to their TCO. Therefore, it is difficult to accurately quantify the impact that NetApp flash solutions can have on a cross-company or even cross-industry basis. However, if we look at the experiences of several customers of NetApp flash solutions and the impact that these technologies have had on those companies’ TCO, we can identify the key areas in which flash technology drives savings and enables companies to grow.

### 2.1 Substantial Reductions of 60+% in Utility Bills and Operating Costs

NetApp flash storage solutions require less energy to operate and run at substantially lower temperatures. For StatPro, a leading provider of portfolio analytics solutions to financial services companies, a recent implementation of Flash Pool™ resulted in annual savings of approximately \$8,500. According to Mike Marechal, the internal infrastructure team lead of StatPro, “From a cost perspective, just in power costs and rack space, going with flash saved us about \$8,500 a year.” Over several years, these savings contribute to a real reduction in ongoing operating expenses compared to what would be expected with hard drives. “Based on what we’ve seen, I think the power consumption of a half-populated shelf compared to that of a fully-populated shelf of spinning disks of 450 gigabytes (a 15K flash drive) was about a 60% to 75% power reduction,” says Marechal.

With fewer moving parts than traditional spinning disks, NetApp flash solutions also can contribute to lower operating costs by cutting down on the maintenance required to periodically replace spinning disks. When describing the decision to implement Flash Pool at Frazier & Deeter, a large accounting and consulting firm, the executive director of IT commented that adding spinning disks would require more “maintenance because as more disks go bad, there are more disks to replace.” This ongoing maintenance drives up the TCO of traditional hard disks compared to a solid-state solution from NetApp.

The significantly lower power and cooling demands of flash-supported or all-flash environments mean that over time, the higher initial cost of the flash solution is offset by lower utility bills and operating costs. The lower annual operating expenses, as reflected by a company’s utility bills, present an easily grasped and quantifiable benefit that demonstrates that the TCO of a flash solution from NetApp is less than that of an equivalent solution composed exclusively of spinning hard disk drives. As an additional benefit to the lower spend on power and cooling, implementing a NetApp flash solution can help companies seeking to promote a “green” and energy-efficient image.

### 2.2 Fewer Racks Mean a Longer Lasting Data Center

Another of the most tangible and widely applicable “soft” components of a flash solution’s TCO is the ability to restrict rack growth, thereby extending the life of a customer’s data center. Traditionally, expanding storage needs have been addressed with the addition of new hard disks. This kind of expansion often requires additional racks, which consume a substantial amount of high-value data center real estate.

“Storage probably takes up a footprint of about 50% of the data center,” according to Brian Gracely, VP of product management at Virtustream, a fast-growing and highly innovative provider of cloud and virtualization solutions to enterprise, government, and service provider customers. To address its growing storage needs, Virtustream has adopted several NetApp flash solutions, including Flash Pool and Flash

Cache™, which provide flash optimization through intelligent caching for the clustered Data ONTAP® software platform. These solutions have dramatically reduced Virtustream's need to expand the footprint of its data centers, shrinking the required future investment, and contributing to the lower TCO of NetApp flash solutions. "With flash, we're seeing consolidation ratios anywhere from 5:1 to 10:1," says Gracely. "Because of the performance that it delivers to us and the lack of footprint that we then have to put in place, flash allows us to hold back on having to add new racks of storage by a quarter to sometimes six months." Gracely states that for Virtustream, the benefits of utilizing flash "were so impactful in terms of reducing the footprint that we need for the racks of spinning disks that we actually had to go through and rework a lot of our planning calculations for how fast we have to add capacity to and open up new space in our data center."

StatPro selected NetApp Flash Pool after determining that it would cost less than acquiring enough hard disks to meet its aggressive performance requirements. As described by Marechal, "Compared to buying the amount of spinning disks that we would have needed to provide the same amount of performance, we immediately identified a cost savings with Flash Pool." It's "not just in the hardware itself that there was less rack space required and less power required. Not needing to acquire an additional rack in our colocation facilities was an immediate benefit for us." Looking forward, StatPro recognizes that adopting an all-flash product, such as the NetApp EF540, would provide the company with further space and power savings in its data centers: "With an all-flash array, we could really reduce our physical footprint because we'd be able to deliver a huge amount of IOPS in a very small space."

A major electronics manufacturer describes the reduction in data center size it experienced when switching to the EF540, an all-flash solution from NetApp: "In the past, with traditional storage, four databases occupied 32 to 44 RAC units. Now the base servers occupy just 8 RAC units, so we've reduced the overall footprint down to a quarter of what it was before."

The enhanced performance of NetApp products, coupled with a smaller footprint in customer data centers, drives the TCO, including future operational spend, of NetApp flash solutions below that of hard disks.

## 2.3 A Little Goes a Long Way

Flash is all about performance. It is undeniable that NetApp flash solutions deliver dramatically enhanced performance over that of a pure HDD environment. NetApp hybrid solutions, Flash Pool and Flash Cache, enable customers to achieve higher levels of performance from their HDD environments by adding a relatively small amount of flash storage to their environments. What customers have discovered is that a little bit of flash can go a long way in driving higher levels of performance that allow for more effective and efficient use of data centers. The significantly lower levels of latency that these solutions enable allow companies to work more quickly, deliver on both internal and external SLAs, and generally offer a better user experience across the board. By allowing customers to operate more efficiently, NetApp flash solutions save customers money, thereby indirectly reducing the TCO of flash compared to that of traditional spinning media.

As a leading provider of virtualization and cloud services to large enterprise customers, Virtustream must offer its customers very strong service-level agreements (SLAs) that address not only uptime, but also application availability and responsiveness. Applications hosted by Virtustream are often a customer's most mission-critical applications and include things such as ERP and supply chain management, the failure of which could be catastrophic for the customer. According to Gracely, "Customers have spent years architecting specific response times, so whether they're interacting with their partners or they're doing transactions that involve payments and so forth, they expect a specific, a very specific, response time."

An inability of Virtustream to adhere to any aspect of these comprehensive SLAs would likely result in the loss of a customer. These SLAs, which vary depending on the customer's service and storage tiers, are seen as key competitive differentiators of Virtustream's service offerings. The ability to offer various tiers and meet the SLAs is driven by NetApp flash technologies, as described by Gracely: "What that lets us do

is it enables us to give customers flexibility to align their applications, and it gives us flexibility in terms of the various price points that we can offer customers. It gives us granularity as to when we choose to use it or not use it based on individual customers' requirements, which is very appealing to us. Having the ability to let customers pick and choose the best balance between performance and prices is really critical to us competing in the marketplace."

Because StatPro is a financial services software firm, its customers place a tremendously heavy demand on the company at the end of every month. As described by Marechal, "One of the challenges that we face is that we have all these financial customers running on VMware and connected to all their databases hosted in our data center, and they all want to do reporting at month end at the same time, so our peak load does everything at one time of the month." Marechal goes on to describe: "We were adding more clients, but unfortunately our latency was growing as well. So that's where we came into some very big challenges from a storage perspective: we have hundreds of databases with hundreds of clients, and they're all trashing the storage array at the same time. We started seeing some significantly larger spikes in latency and were definitely hearing from our clients, especially the larger ones, that things were slowing down, and they weren't happy about it."

Recognizing that this growing latency represented a significant risk to the ongoing growth of StatPro, the company began to explore solutions, including Flash Pool: "We were looking at adding more spindles, and we also looked at Solid State as an option, and after some analysis, we ended up determining that Flash Pool might be a good fit. At that time, the average latency we were getting was upward of 20 to 30 milliseconds, with spikes of up to 100 milliseconds on occasion, which is pretty severe." Marechal describes the almost immediate improvement in latency: "After we implemented Flash Pool, the average latency dropped to about 5 milliseconds. Afterward, one client in particular actually commented that they noticed the improvement and they were quite happy with it."

Although Flash Pool delivered impressive improvements to StatPro's latency, the more important benefit is a happy customer base, which will help position the company for continued growth. Additionally, Marechal describes how the compatibility of Flash Pool with StatPro's installed base led to additional cost savings: "We already had a good-sized installed base, so rather than going and have to buy a whole new flash storage array, or new disks, or new controls, or all these other things, the fact that we could just take some NetApp flash disks, create a Flash Pool aggregate on our existing NetApp aggregates, and basically accelerate all of our existing clients and databases and everything was always a huge advantage. It was a small investment with a huge payoff in the performance department."

## **2.4 A Lot Goes a Really Long Way**

For some customers, extreme speed is critical to delivering strong levels of customer service. For these customers, the NetApp all-flash solution, the EF540, reliably delivers tremendous amounts of speed that simply aren't feasible with a traditional installation of spinning media. The difference in latency between a spinning disk environment compared to that of the EF540 is described by a major electronics manufacturer: "If it was really good, it would be about 8 to 10 milliseconds, with an average about 12 milliseconds. However, in the flash arena things are measured in microseconds ... with the EF540, we saw about 500 microseconds for reads and about 800 microseconds for writes, so well under a millisecond. That's roughly a 100 times improvement." From this manufacturer's perspective, the speed offered by the NetApp EF540, which supports an Oracle® database of customer profiles and facilitates order processing, is critical to maintaining happy customers and keeping them engaged with the company's cutting edge products: "If the website's snappier or faster, you're more likely to stay on that site to just browse around, check things out, and buy stuff. What they don't want happening is someone clicking something and waiting, waiting, waiting, and then you get bored and go someplace else."

## **2.5 Flexibility, Scalability, and Compatibility**

Another key benefit of NetApp flash solutions that indirectly reduces the TCO is the flexibility and scalability that these products offer. Because NetApp has developed a flash-optimized architecture—from the cutting edge clustered Data ONTAP software platform through its entire range of storage products—

NetApp flash solutions can be implemented at the portfolio level across the company's entire product line. Having the most flash-optimized platform available means that all NetApp products are essentially "plug and play." This broad compatibility and ease of implementation, supported by the Data ONTAP software platform, strongly differentiate NetApp flash solutions from those of other storage system manufacturers.

Customers looking to implement a flash solution most typically have experienced or anticipate meaningful growth. They require storage solutions that can grow with their company without needing significant investment in or redesign of existing IT infrastructure. NetApp flash solutions enable customers to rapidly respond to growth by making it easy to add capacity, particularly when dealing with an existing NetApp storage environment. This scalability and compatibility with existing storage infrastructure are key advantages of NetApp flash solutions in that they provide customers with the flexibility to pursue growth opportunities without first making the investment in new storage capacity.

Virtustream typically pursues large customers, and the ability to rapidly add scale is particularly important. Gracely describes the company's needs: "One of the biggest challenges to our business, especially when you target large customers, is that tomorrow we could land a deal that will require 50% more than all the capacity we have today or 100% of the capacity we have today. We needed a storage system that could be very flexible and offer the ability to add very large amounts of data, or very large amounts of capacity, and to do it in a very quick manner." He continues to describe how NetApp solutions addressed Virtustream's challenges: "The ability to add flash as a fairly seamless component to our system is great. What NetApp offered in terms of unified storage—being able to deliver block storage as well as file storage, having integrated capabilities such as backup and DR—was very appealing to us because it allowed us to be very efficient and very cost effective in what we deliver. NetApp clustered Data ONTAP technology lets us scale and continue to add capacity to the system without having to disrupt our customers and without having to radically change our operations."

Frustration with the need to operate different product models with different software, and the skill sets required to manage these different systems, drove StatPro to NetApp several years ago. Marechal describes how the scalability of NetApp products and the common software and protocols between models were highly attractive to StatPro: "With NetApp, we love that we could get a 2000 series or a 6000 series, and, if you know how to manage one, then you know how to manage the other. It's all the same protocol, the same software, the same everything, so that was a huge benefit to us." He continues to describe the ease with which StatPro implemented Flash Pool: "Flash Pool didn't require any additional training or new skills that we had to hire. We just plugged it in, and away we went. It is one of the easiest implementations I've ever done."

Virtustream's experience in implementing a NetApp flash storage solution mirrors that of StatPro in that flash is managed in the same way as other storage. Gracely describes how implementing NetApp flash solutions did not require any additional skill sets: "Operationally, I don't have to go and hire a new person who only manages the flash storage. I hire storage administrators who manage storage and capacity and DR holistically and flash being a piece of that, so there is no additional cost in terms of headcount or training." Because there is no need to hire additional storage administrators with experience in both flash and HDD storage, the TCO of a NetApp flash solution is further reduced.

## 2.6 Reputation and Support

Reputation is important. The NetApp name is well recognized and highly respected. Because it is a global company, its products are heavily tested and proven in the most demanding environments. Customers, in particular service providers, need to know that their data is safe and available when they need it. When dealing with emerging technologies, such as enterprise flash products, customers can take comfort in knowing that they are entrusting their data to one of the best recognized names in the industry.

Marechal recognizes that there were concerns about the stability and reliability of the relatively untested category of enterprise flash storage products. He says, "I think a lot of people seem to have a bit of concern around solid-state disks and just the overall reliability of it." However, he goes on to explain that

one year after implementing Flash Pool, any such concerns are unfounded: “I can say that in the year that we’ve had this implemented, we haven’t had any failures to date.”

Gracely describes how many of Virtustream’s new customers have concerns about the interoperability of their internal data with that hosted by Virtustream: “There is a level of uncertainty where our cloud and virtualization customers want to know what kind of equipment we use, and how we operate it, how many certified people we have, and how they can confidently link their existing systems seamlessly into Virtustream’s for backup and replication.” He goes on to describe how NetApp flash solutions address the concerns of these customers: “NetApp flash solutions help us drive top-line revenue by assuring customers of the quality of our systems and giving them the confidence that if either of us needs something from NetApp, someone will be there to answer the phone. That isn’t something that you can say about some of the other vendors of flash systems out there.”

A number of vendors are selling a range of flash products for the enterprise, but when assessing alternatives, it is critical to account for value that support from a well-established and highly reliable company such as NetApp contributes to the TCO of any storage solution.

### **3 Conclusion: Lower Total Cost of Ownership**

As CTOs, CIOs, and IT procurement officers consider upgrades and expansions of their storage environment, they must look past the sticker price on the box and focus on the TCO. “You have the hard cost, but then you also have the soft costs of cooling, and space, and power; those are costs that people usually don’t put into the equation,” according to the executive director of IT at Frazier & Deeter. These soft costs, which differ from company to company, are critical to understanding the true TCO of a storage solution. Flash storage solutions, at face value, are more expensive than traditional hard disk storage; however, the examples provided in this white paper demonstrate that for many customers, the TCO of a flash storage solution is significantly less than that of traditional storage. An assessment of alternatives that goes beyond the sticker price of the device and accounts for soft costs, including the markedly lower opex of NetApp flash solutions, as well as the benefits the enhanced performance of a flash solution offers, will result in a more comprehensive understanding of the TCO of a NetApp flash solution compared to that of traditional spinning media.



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