White Paper

The Economic Impact and Value of Violin's Flash Storage Platform

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Introduction

Flash storage has changed the IT world by offering a huge leap forward in performance that is easily deployed and broadly available, and those performance advantages have been immediately obvious.

Until flash appeared on the scene seven or eight years ago, storage administrators had been compelled to take multiple creative steps (such as overprovisioning and short-stroking, for example) to boost the performance of regular disk arrays. Higher performance had, therefore, been possible—but only at the cost of significant capacity wastage and (invariably) a considerable human resource cost. In other words, the traditional *real* cost of I/O was a lot higher than the sticker price might suggest. Flash provided not just dramatically better absolute performance, but very welcome relative TCO and ROI impacts as well. Previously, it had been rare to find any storage medium capable of improving performance *and* economics simultaneously.

The Stratospheric Rise, Readjustment Period, and Current Resurgence of Violin

One all-flash external storage array provider, Violin Memory, appeared on the scene as "an overnight success" that grew spectacularly by shipping new flash hardware with vigor and focus as the market segment gained traction.[1] The company may have believed that sufficient excitement and a big enough market opportunity existed to sustain it via hardware shipments alone, but in due course, Violin found that many of its users—especially prospects that are needed to maintain growth—demanded storage that came already well-integrated with appropriate software, management, measurement, and monitoring tools. Beyond some early adopters (significant in size and prestige as they were) for whom Violin could help address mission-critical problems, the great majority of IT organizations simply didn't want an array that required *them* to figure out how to manage and monitor the box by themselves.

Adding software functionality became vitally important to Violin. And by adhering to a strategy of adding and integrating advanced software, Violin is bouncing back. Today, it has new top management, and its engineers are incorporating new performance-centric management features at a healthy pace. Sales and verifiable customer satisfaction are rising.

The resurgence is largely due to Violin adding extensive data services, but it has also been helped by Violin's distinct approach to the hardware side of the business (which it has maintained from day one), and that focus remains important to its strategy and opportunity. Violin is now intently focused on proving that its products bring actual *economic value*, even to organizations that are hyper-scale, hyper-picky, and hyper-demanding.

Its latest announcements include a number of enhancements to *both* hardware and software that should further strengthen it competitively:

- Bolstered functionality.
- Greater consistency of I/O performance.
- Increased scalability.
- Improved TCO, which can drive better ROI.

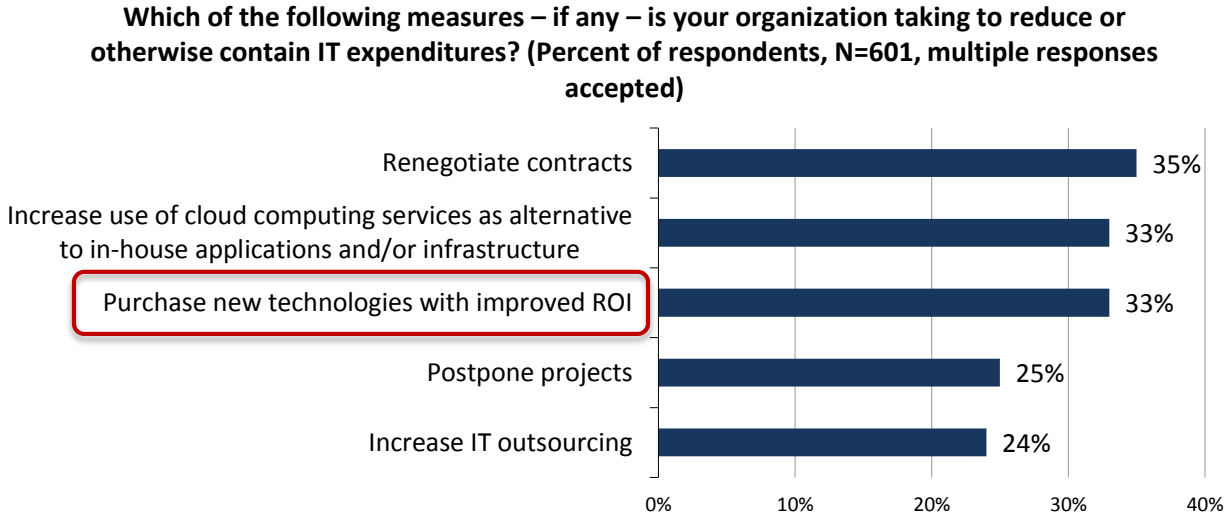
IT Users Demand a Good Return on Their Storage Investments

IT organizations want to see their storage investments provide ever-better operational performance *and* better economics. In fact, ESG research shows that IT managers consider economics (specifically cost reduction and containment) to be extremely important technology spending drivers. In 2015, improving ROI tied as the second most frequently mentioned cost-control measure by surveyed respondents, with 33% reporting that buying new technologies with improved ROI was a step their organizations were taking to reduce or contain expenditures (see Figure 1).[2]

[1] Please note that because of unique architectural characteristics described later in this paper, Violin does not refer to its hardware simply as "all-flash arrays."

[2] Source: ESG Research Report, *2015 IT Spending Intentions Survey*, due to be published in February 2015.

Figure 1. Top Five IT Cost Reduction/Containment Strategies, 2015



Source: Enterprise Strategy Group, 2015.

Setting the Stage for a Flash Array that Delivers Economic Value

Violin's hardware design has always been distinctive. At times, the vendor's leaders may have wondered if the approach really was the best way to go. It certainly hadn't been easy for the engineers to bring the visionary design to life. But they did, and now that design is paying major dividends to Violin's customers.

Specifically, since 2007, Violin has been putting individual flash chips on their own cards, then integrating those cards into the arrays' backplanes. The cards are known as Violin Memory Modules, or VIMMs. VIMMs are instrumental to optimizing Violin arrays by providing a way to achieve more of a "reach into the flash" to enable high parallelism, resiliency, and fast, *consistent* I/O performance.

Designing a flash card from scratch, then arranging for its custom manufacturing, is no lightweight decision. That's why many other flash array vendors instead choose off-the-shelf, general-purpose solid-state drives—flash packaged to mimic a disk drive's dimensions and form factor. Using off-the-shelf SSDs reduces a vendor's R&D-related efforts dramatically, allowing it to bring an array to market sooner.

It would have been easy for Violin to opt for the off-the-shelf route, too. But Violin didn't want to "make do" with whatever microcode the SSD manufacturer had decided to use or whatever limits that "subcontracted" situation put upon Violin's abilities to manage the media, not only in terms of performance, but also in terms of economy. So it has been putting significant effort into producing VIMMs that also offer excellent density. Using VIMMs gives Violin additional control, too—it has designed its flash architecture to achieve exactly what it wants in regard to how its array interfaces with the flash capacity inside of it.

And now, VIMMs and the other hardware features unique to Violin are being enhanced with highly capable software functionality. It simply means Violin has an enhanced ability to deliver flash arrays that are *capable of providing real-world economic value*.

"Predictable, consistent I/O performance is needed to meet the IT demands of the business, especially for business-critical applications with strict service level agreements. High average I/O response times are a great performance metric, but what really matters is *consistently* high response times. No one cares that 99.999% of your I/Os complete in less than a millisecond when the phone starts ringing after an application crashed because a single I/O took more than a second to complete."

—Brian Garrett, VP, ESG Lab

I/O Performance Consistency: Where the Economic Value Really Shines

Imagine bolting a generic engine into your car's chassis. You may get decent highway speed with that configuration, or you may not. Now picture a high-performance race car with a custom engine built specifically to provide jaw-dropping speed under all conditions. And think about how intimately the automotive engineers who designed that engine know it, inside and out. In a way, Violin's approach to creating its arrays has been similar.

For example, at first glance, Violin's Flash Fabric Architecture (FFA) may merely look like Violin's way to enable the management of whatever happens to be going on inside the box. But FFA is actually a customized, all-silicon design operating at line rates using patented flash-optimization algorithms implemented in the hardware. It's a far cry from anything one could pull off a shelf.

FFA permits deep *and* wide examination of I/O-related attributes, allowing Violin and its customers to manage storage performance as they wish. Violin's newest offerings in particular—the 7300 and 7700 Flash Storage Platforms—provide impressive, dependable, spike-free I/O. Also of note:

- **Violin made everything faster** in the 7300/7700 systems. And when everything is faster, it becomes easier to maintain I/O consistency. The arrays have been given more "headroom" with which to perform.
- **Violin owns the design of everything** in the arrays. It created FFA to provide greater concurrency and parallelism, and it designed its VIMMs to offer tighter integration and ultimately more insight. The result—systems with great control over how they use resources to provide not only consistent I/O response, but also consistently *fast* I/O response.

The Value One Violin Customer Sees

In 2014, Portugal-based e-billing provider Saphety experienced how valuable I/O consistency can be in a data-intensive environment.

Saphety's business model demands 99.999% availability, but fast growth made it difficult for Saphety to meet its SLAs.

Deploying Violin flash storage made a huge difference. Reporting processes that had taken 24 hours to complete were finishing in fewer than two hours. Latencies of 15-40 milliseconds shrank to a consistent 0.2-0.3 milliseconds.

Customers were happier, and at last, Saphety could proceed with a VMware migration earlier delayed by performance and scalability challenges. It was able to consolidate physical servers from 21 down to 9, and that move brought savings in power, cooling, floor space, application licensing, ongoing maintenance, and server management.

The Business Value of I/O Consistency

"Performance consistency" sounds nice, but how does it provide economic value? The key is *operation without uncertainty*. As an unlikely (but good) example, think about tape. It's perceived as being slow compared with other digital storage media, but tape automation ensures that response times—even if relatively lengthy—are consistent. As long as IT can be certain that a response from tape will *always* take 30 seconds, that's okay: It's easier to work around a guaranteed 30-second response than it is to work around random responses ranging from ten seconds to three or more hours (which had been the kind of inconsistency common in manual tape environments).

Back to primary storage: In general, IT managers today are almost numb to the amount of effort they must expend to "manage around" the mechanical delays and I/O inconsistencies of traditional disk storage. Layers of overprovisioning and caching build up over the years, but storage administrators just regard managing it all as "something we have to do."

With the luxury of a lack of *un*certainty, an IT organization can plan better and thus reduce its storage TCO by using the equipment it owns more thoroughly. Less equipment needs to be bought, and that means lower CapEx. If that

organization can postpone a $50,000 hardware investment for one year, ESG assumes it could use the money saved to earn a 5% return in that year, netting a $2,500 benefit.[3]

That's just the beginning. ESG uses a default cost of $2,650 per terabyte for high-end raw storage capacity. If a high-end storage user can completely eliminate the need to buy, say, just 50TB of capacity, the CapEx savings amount to $132,500. And of course, with less equipment to manage, OpEx goes down, too.

On the other side of the same coin, I/O consistency allows an organization to improve the return it gets on a storage investment. It's all about delivering more output than was possible before. *The ROI improvement resulting from getting more workloads onto an array can equate to many tens of thousands of dollars.*

I/O performance consistency enables an organization to completely remove a problematic variable affecting it negatively on business and technical levels that it historically always had to take into account. IT staff no longer need to tell end-users, "It'll take three seconds/minutes or three days/months" to get a response from a database or push out some new application. Everyone involved will know that an I/O response will occur within, say, 0.5 milliseconds *every time*. Such knowledge makes planning and forecasting more efficient.

Key Technical Enhancements of 7300/7700

- Upgraded controller and VIMM architecture—a step up in terms of consistent performance. This greater processing ability makes everything faster/better, and it means "hidden" necessities (like garbage collection) have less impact on getting real work done.
- Enterprise data services in a single 7300 FSP 3U array—thin provisioning, cloning, app consistent snaps, *granular* block deduplication and compression, replication, continuous data protection, and mirroring.
- Modular 7700 FSP delivers synchronous replication, stretch metro clusters, and scale up to 1.3PB effective in a single namespace.
- Concerto OS 7 code in upgraded 7000 heads.

The business value of I/O consistency ties back to (1) the TCO improvements that efficient flash brings to a storage environment, and (2) the positive ROI impact that efficient flash has on business outcomes. In the real world, whether one likes it or not, economic considerations have a huge impact on storage deployment choices. Fortunately, Violin's 7300 and 7700 flash storage platforms affect both the TCO and ROI sides of the economic equation positively.

The Technical Value of I/O Consistency

With array capacities that can reach more than a petabyte, effective pricing (according to Violin) that can reach $1.50 per gigabyte, and all the engineering work to implement practically every storage feature and function one might wish for, Violin could justifiably indulge in the "hero number" chest-beating that's endemic in the solid-state storage world. But hero numbers rarely reflect how value is derived. Value comes by enabling users to do more things, to do new things, and to do all things better than before.

Violin's data services are built to optimize the value of flash, and everything has been improved in the 7300 and 7700 systems. Upgraded controller processors, VIMMs, and a fourth-generation Flash Fabric Architecture provide consistent low-latency performance. Violin has even reduced the negative impact that background processes such as garbage collection have on getting real work done. The Violin Concerto 7 Operating System's existing enterprise data services (including thin provisioning, cloning, snaps, synchronous and asynchronous replication, stretch metro clustering, continuous data protection, and mirroring) are bolstered with *granular* block deduplication and compression and can be integrated across the Violin range for added efficiency and investment protection.

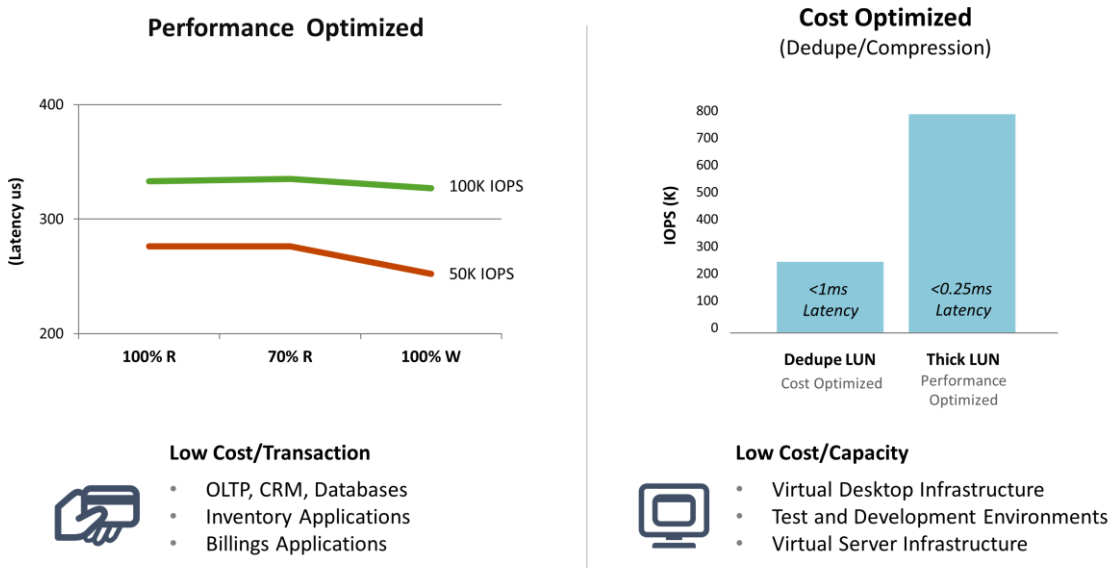
The solution's deduplication and compression features can help organizations save big money. Those features are mainly aimed at improving TCO, while the consistent low latency and high parallelism are the keys to enabling many more workloads to be run per array and thus significantly driving up ROI.

[3] The "ESG numbers" in this section are drawn from ESG's advanced Economic Value Validation practice/model. That model stems from multiple sources to give a fair market default value for certain common items and expenditures in IT.

Violin wants to show prospects who have been bombarded by flash vendor claims that its architecture really is different, not just in terms of having a significant performance advantage, but also in having attributes that provide an economic advantage (see Figure 2).

Violin's engineers are gathering both modelled and early-user evidence to show that the consistent low latency and high parallelism built into the 7300/7700 architecture can help organizations get many more workloads on an array, thus dramatically improving the economic return on their storage investment: You can load it up and get much more out of your data center than you could with a good-enough solution based on SSDs.

Figure 2. Performance or Cost-optimized Capability



Source: Enterprise Strategy Group, constructed from Violin data, 2015.

The Bigger Truth

All active data should be on flash, but IT organizations need to be thoughtful about the flash-based solution they choose. Differences exist that might not be obvious superficially. Think about it this way: Practically any car can go 70 MPH, but that doesn't mean you want any old car. Maybe you want to do 150 sometimes. Maybe you want to do "just" 70 MPH while carrying 100 passengers (i.e., supporting 100 workloads). Maybe you don't want any old car. Maybe you want a "Ferrari bus." And of course, you want varied and dynamic capabilities, too, so perhaps the Ferrari bus has some ATV characteristics as well!

For buyers, it pays to check. In storage, as anything becomes a norm (as all-flash arrays have), we sometimes assume that competing products are more similar than is actually the case. Violin already had impressive capabilities and functionality, and its new enhancements extend them. Violin is also determined to remain price/value aggressive and has tremendous credibility in that regard from many publically referenceable, exceedingly loyal users. Maybe Violin's subtle moniker change from all-flash array to "Flash Storage Platform" for its new products will help it stand further apart from the crowd.

In a strict semantic sense, Violin's 7300 and 7700 are indeed just more all-flash-array announcements, but Violin's technology foundation has always been intentionally distinct in ways that can deliver significant value to IT users. And that's the true point: All of the improvements bring a *positive economic impact for users, both at an IT scale and a business scale.*

The bottom line is that Violin has products that provide a compelling mix of data services, performance, scale, and business value—perfectly suited to supporting seriously demanding IT environments. Violin can therefore in many respects be described as providing a multi-purpose, multi-terrain "Ferrari bus."

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