CLABBY ANALYTICS

Research Report

Violin Memory's Flash Storage Platform – Innovative, Optimized and Software-Driven

Executive Summary

Violin Memory has a history of technical leadership in flash storage. The company holds forty US patents, has forty-one US patents pending and has a total of ninety-two patents either issued or pending globally. These patents are all related to improving flash hardware scalability and performance – and most of these improvements are being driven by advanced software.

> *A closer look at Violin Memory's Flash Storage Platform shows that the company builds standards-based storage arrays with hardware extensions designed to improve resiliency, scalability and performance. The company also invests heavily in software designed to exploit its underlying hardware to further optimize performance and assure array availability despite local or regional threats.*

Some research analysts argue that the Violin Memory approach to tuning its underlying hardware using patented software extensions makes those extensions proprietary. To this, we respond: "balderdash!" We argue that Violin Memory is doing exactly what it should be doing:

- Taking standard hardware components;
- Arranging them in such a way as to maximize performance and scalability;
- Augmenting that hardware with other hardware extensions that further improve performance and scalability; and then
- Further tuning and optimizing its arrays using advanced software.

Other research analysts argue that the market wants "software defined storage" software programs that can extend the functionality of commodity storage. And this is true for some market segments. But the big question is: "can storage developers, using software defined storage approaches, build and optimize storage subsystems better than the designers and manufacturers of advanced hardware arrays like those offered by Violin Memory?"

In this *Research Report*, *Clabby Analytics* takes a closer look at Violin Memory's hardware, software and patent portfolios. What we find is that *Violin Memory is using its deep research and developmental expertise to write patented software that advances the hardware scalability and performance of its storage products to levels that we doubt can be achieved by developers of software-defined commodity storage solutions.*

Introduction

By now, most businesses understand the economics of flash storage as primary storage for enterprise level data center applications. The cost of flash storage itself continues to drop, and that combined with the economic benefits of lower latency, higher performance,

scalability and density, and increased efficiency of flash over HDD creates a compelling argument for all-flash storage for an increasing number of high-end (Tier 0, Tier 1) applications and mixed workloads. Software features such as deduplication and compression reduce storage capacity requirements, are also contributing to the value of flash storage. IDC expects the all-flash array (AFA) market to grow at a 22.5% compound annual growth rate from $2.238 billion in 2015 $5.05 billion in 2019. But as vendors continue to offer solutions to address this growing market, how can businesses best take advantage of flash technology to maximize its benefits?

How Violin Memory Tunes its Flash Storage Platform
Violin Memory's all-flash arrays, the Violin Flash Storage Platform (FSP), provide a vertically integrated purpose-built platform that delivers custom engineered hardware, firmware and software to enterprise data centers. This end-to-end tightly integrated software-driven platform is optimized to exploit flash technology for consistent high performance and low latency and to deliver services such as continuous data protection, in-line selectable data deduplication and compression, and application-consistent snapshots, amongst other data services.

> *What effect does Violin Memory's "extreme" tuning have on price/performance? Violin reports that its Violin 7300 FSP costs up to 84% less per transaction than SSD-based arrays. These economic and business benefits can be directly attributed to Violin's investment in flash technology innovation at the hardware, software and firmware levels. Resulting intellectual property is what gives Violin Memory distinct competitive advantages over other Flash-based storage offerings.*

Examples of Violin Memory Optimization that Provides Distinct Competitive Advantage
Examples of how Violin Memory uses hardware and software to create distinct competitive advantages abound. Consider the following:

- A flash-optimized architecture that uses "Flash chips" instead of solid state drives (SSDs) for improved scalability and performance and better storage density using a direct connection to flash rather than going through an SSD controller.

- Chip-to-chassis integration of hardware components known as the Flash Fabric Architecture™ (FFA), an *all silicon approach that uses patented flash optimization algorithms* that enable thousands of flash devices to operate efficiently together. This level of integration provides a seamless I/O flow from the host bus adaptor (HBA) to the flash system and creates a layer that masks chip-level design issues for reliable, consistent, low latency and high performance. This "mesh" architecture spreads data over thousands of flash chips to avoid hot spots and improve data resiliency.

- "Violin Intelligent Memory Modules" (VIMMs) organize flash chips into intelligent flash management units which intelligently distribute and parallelize I/O for more efficient read/write performance and "garbage collection", as well as wear leveling and error/fault management services. This creates the consistent low latency that is critical for virtualized environments, without the latency spikes found in hybrid or SSD-based designs that result in unpredictable application performance.

- vRAID, Violin's patented flash technology is designed specifically to enhance flash system performance and provides full RAID data protection and a more efficient and higher performance solution that is highly redundant; and,

- Violin Memory has also invested in its Concerto OS operating environment – optimizing all aspects of the FSP for improved manageability, availability, performance and efficiency, and includes built-in data services and selectable data reduction capabilities.

  o The layered, vertically integrated design provides consistent, reliable performance and low latency, while maximizing the value of software-based services.

These are just a few of the many examples of how Violin Memory is using its research and development expertise to build and patent new solutions for the storage industry.

Summary Observations

A behind-the-scenes look at what Violin Memory is doing to optimize its hardware, firmware and software shows that the company has developed dozens-upon-dozens of new insights that have resulted in new patents being issued to Violin. As examples, consider that the company has found new ways to identify invalid cache data, correcting errors in data using a compound code, reassembling abstracted memory access for prefetching, improving transactional consistency, improving the reliability and speed of broadcast data, maintaining coherence during offline changes to storage media – and has applied for patents for many, many more of its insights. The end result of Violin Memory's patent activities is that the company can protect its intellectual property while continuing to deliver outstanding performance and highly-differentiated functionality to its customers.

Some research analysts and members of the press look at Violin Memory's specialized hardware and unique, value-added software and conclude that the company's products feel proprietary (these are typically analysts and reporters who see software-defined storage as the wave of the future in storage subsystems). We, on the other hand, look at Violin Memory as a company pushing the envelope in storage hardware – as well as providing extreme optimization in software – to deliver clearly differentiated storage solutions to its customers. Violin's many patents show its design and innovation brilliance – a brilliance that many competitors wish they could emulate.