Beyond the Features: Flash Storage Best Practices

Eric Herzog, CMO, SVP Alliances

Flash: Revolutionizing Data Center Economics

Status Quo

Violin All-Flash

Storage
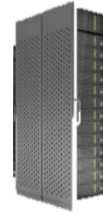
Over-Provisioned

✓ Up to 90% Reduction in Storage Costs

Servers

Under Utilized

✓ Up to 80% Reduction in Cores/Servers

Apps

Licensed By Core

✓ Up to 70% Reduction in Software Licensing
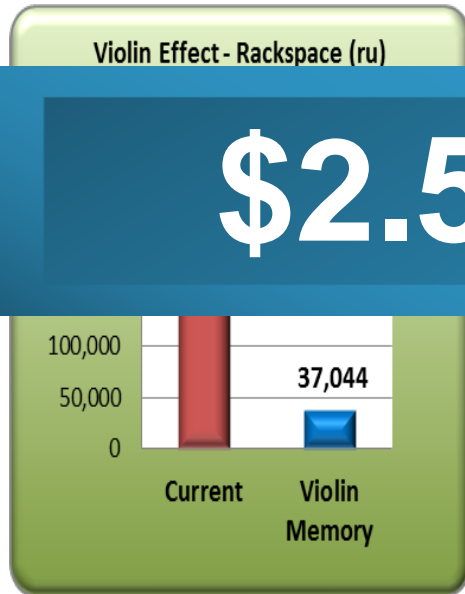
Data Center

Limited Real Estate

✓ Up to 90% Reduction in Power/Space/Cooling
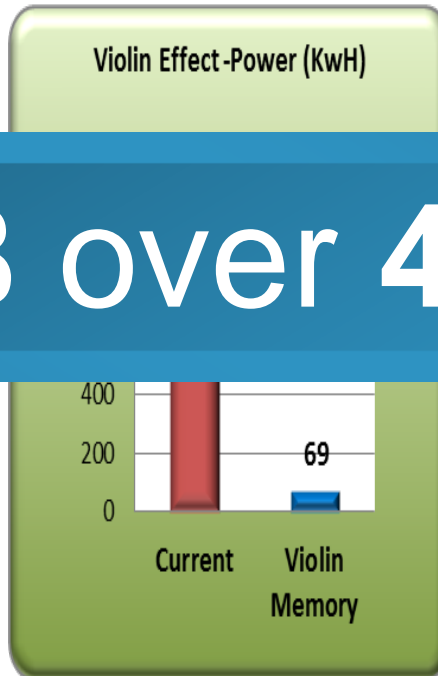
Global Fortune 500 Company

Space Savings

Violin Effect - Rackspace (ru)

100,000
50,000
0

37,044

Current / Violin Memory

85% Reduction

Power Savings

Violin Effect - Power (KwH)

400
200
0

69

Current / Violin Memory

93% Reduction

Total Annual Savings

Violin Effect - Total annually Server and Storage OPEX

$1,200

$200
$0

Current / Violin Memory

71% Reduction

$2.5B over 4 years

Source: Global Fortune 500

Violin Memory: Revolutionizing Data Center Economics

Delivered a latency of 120 microseconds 8 milliseconds with legacy storage.

"Batch reports that took five [hours] now run in 90 minutes."

"We increased the query capacity of our eDiscovery system by 6x"

Over $1.2 million savings in OPEX/CAPEX.

Video streaming application runs 10X faster on Violin flash storage.

ERP system is running 4X faster on the Violin platform.

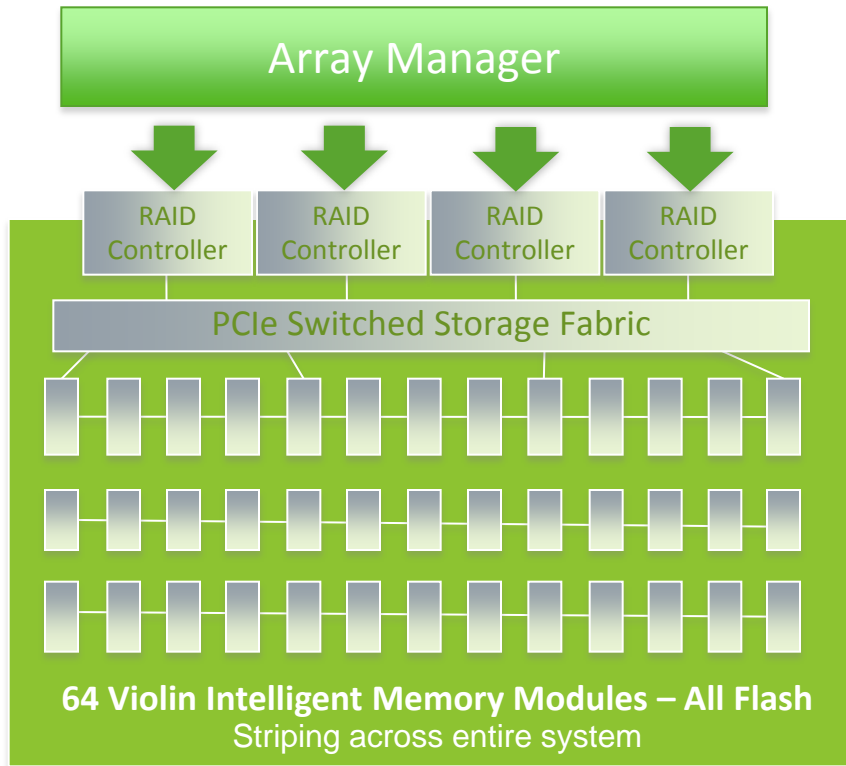*"With Violin technology the data is ready, waiting for us whenever we need it"*

"Achieving up to 800% improvement in VM creation time."

Nightly reports reduced by over 7X, down to 50 minutes from 6 hours.

Flash Fabric Architecture™

Array Manager

RAID Controller | RAID Controller | RAID Controller | RAID Controller

PCIe Switched Storage Fabric

64 Violin Intelligent Memory Modules – All Flash
Striping across entire system

Built for Concurrent
Mixed & Multiple Workloads

Performance

o Over 500K sustained IOPS at sub .5ms latency with mixed, heavy workloads using MLC Flash
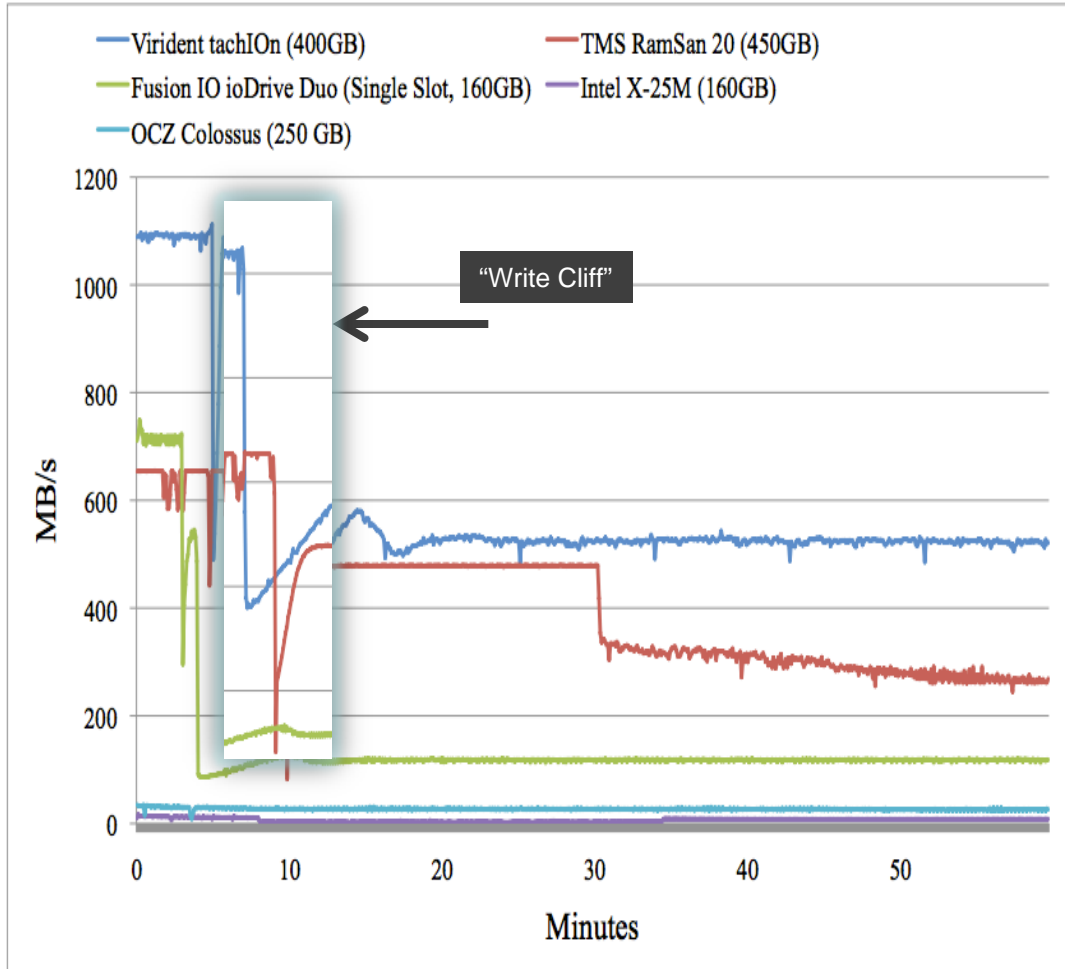
o Automatic Quality of Service

Density

o 70TB raw in 3RUs and low power (500W/RU)

Resiliency

o Automated, transparent GBC in the background without application performance impact

o Designed for long flash life with array-wide flash management, wear leveling and vRAID

Write Cliff Affects All Flash Solutions To Some Degree

Legend:
- Virident tachIOn (400GB)
- TMS RamSan 20 (450GB)
- Fusion IO ioDrive Duo (Single Slot, 160GB)
- Intel X-25M (160GB)
- OCZ Colossus (250 GB)

"Write Cliff"

Y-axis: MB/s (0, 200, 400, 600, 800, 1000, 1200)
X-axis: Minutes (0, 10, 20, 30, 40, 50)

Transient Random Write Bandwidth Degradation
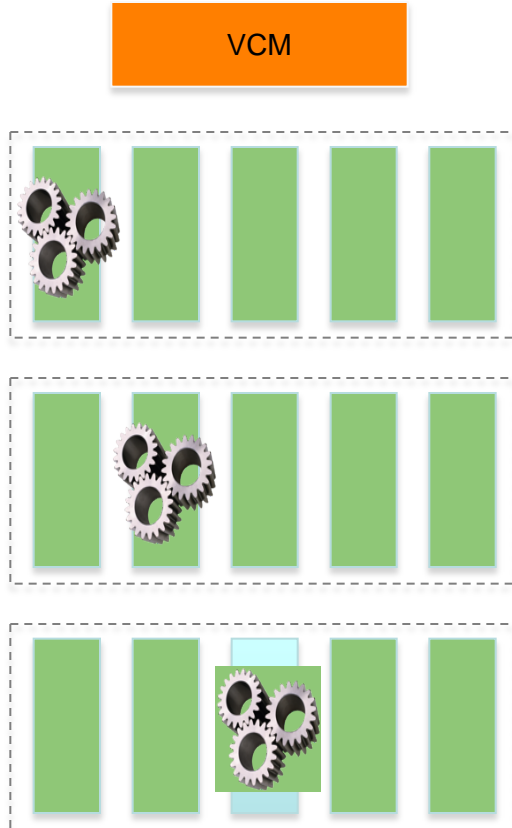
Source: Nersc

- New Write operations get queued behind Erase operations
- Up to 60% performance drop
- Real issue is that Erase operations also get in the way of Read operations
- Mitigating or eliminating the Write Cliff requires special flash management logic
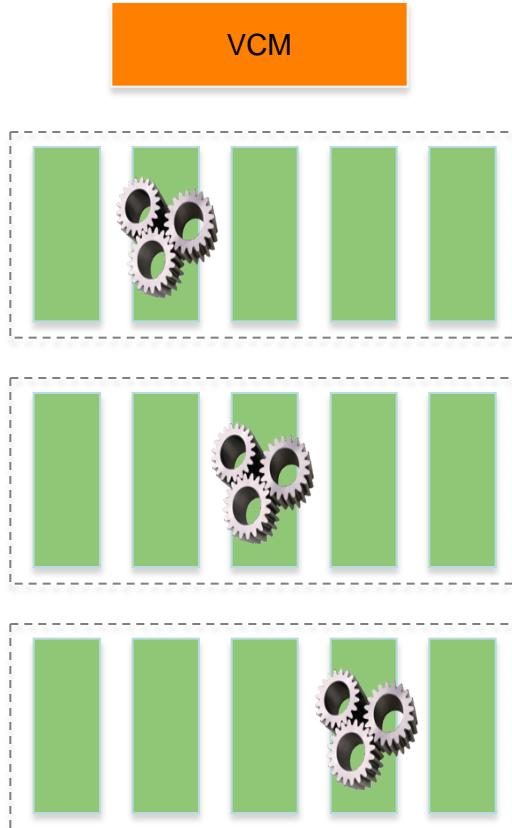
Patented Algorithms Deliver Spike-Free Low Latency

VCM

o Background garbage collection ensures free pages for all incoming writes

o Garbage collection implemented in hardware within each VIMM for line rate performance

o Garbage collection tightly scheduled & orchestrated at the system level to not affect system performance

o Garbage collection allowed one VIMM per Protection Group at a time

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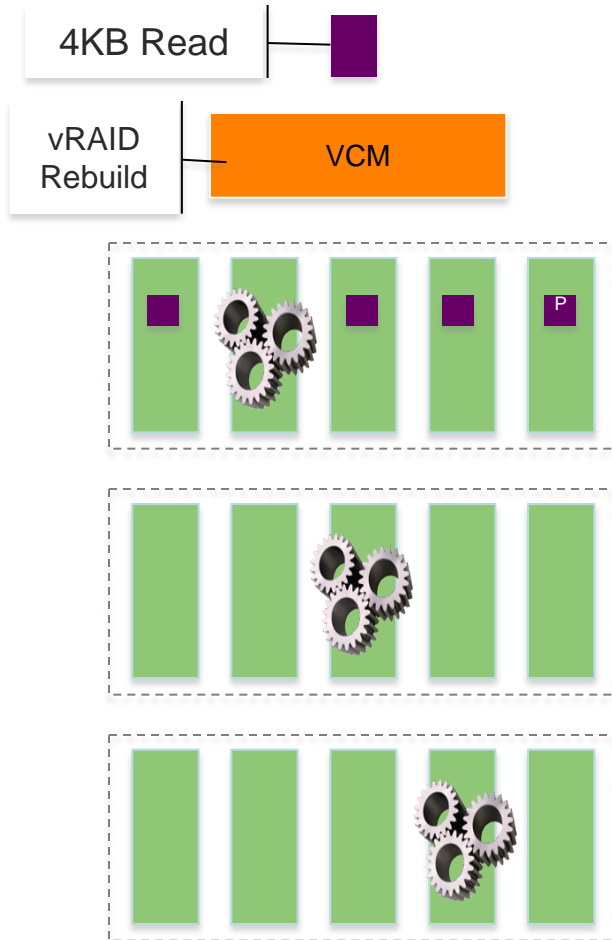- o Garbage collection allowed one VIMM per Protection Group at a time

vRaid Erase Hiding in Action

4KB Read

vRAID Rebuild — VCM

- o Reads never blocked by garbage collection (vRAID rebuild on remaining 4 VIMMs)
- o System level orchestration enables sustained low latency for mixed workloads

Comprehensive Data Services Software

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> **"Forward-thinking CIOs use flash to lower their costs, but there are still many who hesitate to try the technology. Many argue that they can't afford the huge gap between flash and HDD price per gigabyte, but they lose sight of the fact that the system's capital and operating costs both dramatically drop once flash is applied."**
>
> Jim Handy, Director Objective Analysis

Data Protection

Thank you