Online University Learns the Power of SanDisk®

University adds Fusion ioMemory™ solutions to eliminate database performance issues and related support tickets, improve productivity, and simplify infrastructure.

Summary of Benefits

- 30x faster queries
- Replication reduced from minutes to seconds, ensuring end users get most up-to-date data
- Completely eliminated complaints and support tickets about intranet performance
- Eliminated the need to purchase application servers by repurposing freed database servers
- 50% reduction in database server hardware
- Implemented full failover redundancy with just two servers
- Slashed future capital and operating expenditures

The Challenge

A leading online university hosts an intranet that employees access to do most of their work. Consequently, if performance drops, so does productivity. When its intranet databases began to slow, it tasked its lead systems engineer with finding a solution.

The university's initial intranet infrastructure consisted of four MySQL database servers that supported three application servers. These application servers hosted multiple productivity applications. As the system team began investigating application and database slowness, it became evident right away that disk latency was the primary performance problem.

The Solution

The lead systems engineer had been watching SanDisk for years and was confident its Fusion ioMemory ioDrive® cards could solve the university's problems. After evaluating several options, he and his team agreed that SanDisk was the best solution to resolve the university's disk latency issues.

Running the Benchmarks

The university ran benchmark tests comparing eight 15K RPM SAS drives configured in a RAID 10 to one ioDrive® Duo card with its two DIMMs striped in a RAID 0.

This table shows the benchmark results, reported in megabinary bits (MiB) of 1024k (higher is better).

	8 x 15k Disk Array	ioDrive Duo
MiB/sec		
Random Reads	150	1,006
Random Writes	272	626
IOPS		
Random Reads	3,548	110,000
Random Writes	3,517	145,000

Improving Queries

The week before it deployed the ioDrive cards into production, the database team had run a long query that took 2 1/2 hours to complete. On a whim, the engineers asked a DBA to run the same query again on the ioDrive system. They then left for an hour-long meeting, hoping the query would be done by the time the meeting ended. Five minutes later, before the meeting even started, the DBA called saying, "It's done. What's the next test?"

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"Since implementing the ioDrive cards, query performance has ceased to be a problem. Our DBAs still tune queries, of course. But from a system engineer's standpoint, I no longer have any reason to ask them to." said the lead engineer.

Speeding Replication

In the previous system, the replication lag between the master and read servers often resulted in stale data. To end users, it could appear as if updates hadn't occurred, resulting in support tickets that were "magically" fixed by the time the support team investigated and replication had caught up. The ioDrive system replicated the largest transactions in mere seconds instead of minutes, completely eliminating this problem.

Eliminating Performance Complaints

The university deployed the SanDisk powered system over the holidays, immediately putting the ioDrive cards' scalability to the test, as January is the university's busiest time of the year. Typically, this spike in activity severely taxed the system and presented support a corresponding increase in performance-related complaints. However, the SanDisk powered system handled the spikes without any noticeable impact on performance.

For once, support wasn't fielding performance tickets, and employees were able to focus on doing their work instead of waiting on applications.

"Since deploying the ioDrive cards, our support team hasn't received a single support ticket related to the intranet application and database performance," the lead engineer told us. "That, to me, is the most important benchmark of all."

A Simple and Elegant Architecture

With recommendations from SanDisk's expert field engineers, the university's system team devised an architecture that eliminated key I/O and CPU bottlenecks, while actually simplifying its system.

The new database layer replaced the four database servers with just two new Hewlett-Packard DL380 servers, each equipped with a 640GB ioDrive card.

Initially, the lack of infrastructure caused some concern about reliability, as management had come to equate adding hardware with reliability. However, the lead engineer pointed out several strengths of the SanDisk powered system. First, the ioDrive cards didn't have the additional data hand-offs between controllers, RAM caches, and between the host and storage media, each of which could compromise integrity. Second, the new system had a much simpler outage scenario now that it consisted of two servers instead of four. If the master server failed, the SanDisk system's replication allowed the read server to change to a fully functioning master much faster, reducing the risk of data loss. Like the previous system, the new master server maintained a read pool that allowed it to serve as both master and read if the read server failed, without disruption in service.

In addition to the advantages ioDrive cards had over the previous system, the engineer noted the data integrity advantages inherent in ioDrive cards. He told us, "With the Fusion ioMemory product, I know my data is protected. The capacitors on the SanDisk cards will never die, and I'll never have to perform maintenance."

Thus, with half the servers, the system team got both a more powerful database layer and a more reliable one.

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Lead Systems Engineer
Online University

Enabling Efficient Asset Use

The ioDrive cards' performance eliminated I/O bottlenecks in the university's database. However, this newfound performance exposed another bottleneck – the university's applications were CPU-bound. But this ended up being a non-issue since the ioDrive card purchase had freed up four servers, the systems team was able to repurpose these as application servers to redistribute the CPU load and further improve application performance.

ROI on Steroids

One of the most compelling aspects of the SanDisk solution was its return on investment (ROI).

- First, the university repurposed four database servers as application servers, eliminating the need for new hardware purchases while also improving application performance.
- Second, the SanDisk powered systems have CPU capacity to spare. The lead engineer told us the databases only use an average of 20% of their processing power, so he doesn't expect the university will need to upgrade the database servers again during the life of the ioDrive cards.
- Third, the university cut the database layer's hardware and software administration overhead by half.
- Finally, the university eliminated the floor space, power, and cooling costs of the additional servers.
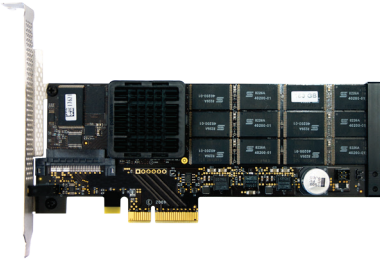
Evaluating Competing Solutions

While making its purchase decision, the systems team evaluated several solutions against a 100,000 IOPS performance threshold.

The team ruled out SANs almost immediately since, as the lead engineer put it, "It would have taken hundreds of disks to equal the performance of just one ioDrive card."
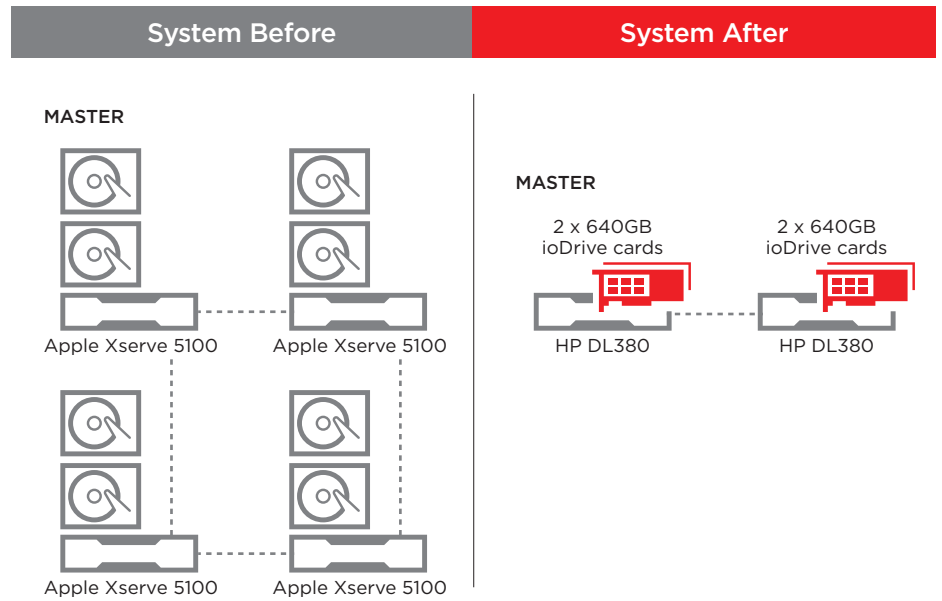
The lead engineer told us, "There wasn't enough space in a single server to get 100,000 IOPS and by the time we aggregated everything, the Fusion ioMemory solution came out cheaper. Additionally, we would have had to purchase multiple RAID controllers with failure groups and a hot spare. The complexity and expense of other options made SanDisk a no-brainer."

Competing PCI Express SSDs were also ruled out for two reasons. First, as described above, the reliability issues created a concern. Second, these solutions cost much more for equivalent performance.

Fusion ioMemory™ - ioDrive®

System Overview

System Before	System After

MASTER

Apple Xserve 5100   Apple Xserve 5100

Apple Xserve 5100   Apple Xserve 5100

MASTER

2 x 640GB ioDrive cards   2 x 640GB ioDrive cards

HP DL380   HP DL380

MySQL 5.x on Mac Xserve Cluster
- Four Apple servers
- Eight 15K RPM SAS drives

Changes to the System
- Replaced the four Apple servers with two new HP DL380 x550 processors and two 640GB ioDrives
- Repurposed two of the four database servers as application servers

Performance per Rack Unit (Density)

With SanDisk

Without SanDisk

Query processing reduced from 150 minutes to 5 minutes, delivering 30 times the performance in the same rack space.

30X IMPROVEMENT

Summary

Implementing the Fusion ioMemory solution gave the university the following benefits:
- 30x faster queries
- Replication reduced from minutes to seconds, ensuring end users get the most up-to-date data
- Completely eliminated complaints and support tickets about intranet performance
- Eliminated the need to purchase application servers by repurposing freed database servers
- 50% reduction in database server hardware
- Implemented full failover redundancy with just two servers
- Slashed future capital and operating expenditures

The lead engineer told us, "Our team is thrilled with the results and can't wait to use the ioDrive cards to consolidate other areas of our system."

Contact information

sales-hp@sandisk.com

Western Digital Technologies, Inc.
951 SanDisk Drive
Milpitas, CA 95035-7933, USA
T: 1-800-578-6007

Western Digital Technologies, Inc. is the seller of record and licensee in the Americas of SanDisk® products.

SanDisk Europe, Middle East, Africa
Unit 100, Airside Business Park
Swords, County Dublin, Ireland
T: 1-800-578-6007

SanDisk Asia Pacific
Suite C, D, E, 23/F, No. 918 Middle Huahai Road, Jiu Shi Renaissance Building
Shanghai, 20031, P.R. China
T: 1-800-578-6007

For more information, please visit:
www.sandisk.com/hp

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