



Pandora Makes Hot Content Sing with a SanDisk® Powered Content Cache

Leading personalized internet radio station uses SanDisk Fusion ioMemory™ solutions to expand frequently-accessed cache capacity without scaling system cost and complexity.

Solution Focus

- Digital Content Caching
- Web 2.0

Summary of Benefits

- **10x more** cache per server to enhance user experience
- **10x larger** overall cache to support future growth
- **7 to 8x** workload capability per server slows scale-out spending
- **Replaces** larger, RAM-heavy servers with smaller, more power-efficient servers
- **40% smaller** server footprint
- **Eliminates** hard disks for frequently-accessed content to greatly extend life of existing disk infrastructure and defer expensive disk upgrades
- **Open system** and **expert SanDisk staff** assists with designing optimal system with existing VARs and hardware partners

The Challenge

Pandora is personalized radio, combining the attributes of “original” radio and magnifying them with a combination of proprietary personalization technology and Internet technology—enabling a level of personalization and discovery for each and every individual. Pandora is available everywhere consumers are via a variety of connected devices, such as computers, mobile phones, tablets, automobiles, and TVs. Pandora accounts for more than 69 percent of Internet radio listening in the U.S. today.

Pandora maintains a large caching farm for frequently accessed content to ensure the seamless listening experience its customers have come to expect. Aaron Porter, Pandora’s Director of System Administration, described the challenge Pandora’s growing popularity presented to its caching tier: “Quality audio delivery to our many listeners is a major part of our production operation. In order to provide the best listening experience to more than 125 million registered users, we needed a solution that offered greater scalability and reliability.”

As part of an innovative company that’s changed the way many listen to radio, Aaron and his team were confident they could find a solution that could:

1. Ensure the high performance its users had come to expect
2. Slow server scale out
3. Improve hard-disk utilization
4. Reduce maintenance overhead

The Solution

After hearing about SanDisk’s Fusion ioMemory™ solutions through product reviews in the press and by talking to peers, Aaron decided to give the Fusion ioMemory ioDrive® cards a try. Aaron and his team were impressed with the results.

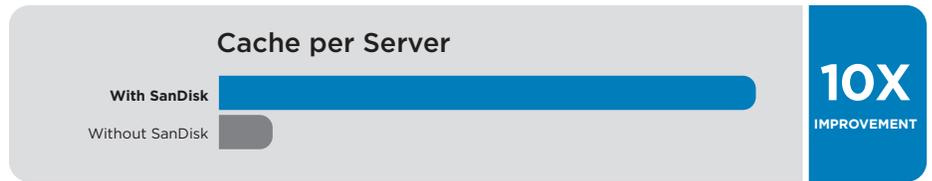
More Cache to Support More Music Lovers

In the world of caching, size matters. Pandora had been investing in servers loaded with RAM to ensure a quality user experience. Aaron found that ioDrive cards proved a better alternative without compromising quality.

“The ioDrive cards perform as well as our RAM caches, but offer 10 times the capacity per server,” Aaron said. “Our total frequently accessed music cache now holds 10 times the songs it used to, which both enhances existing user experience and gives us plenty of headroom for future growth.”

“Our total frequently accessed music cache now holds 10 times the songs it used to, which both enhances existing user experience and gives us plenty of headroom for future growth.”

Aaron Porter,
Director of System Administration
Pandora



Aaron noted how the ioDrive solution’s performance would slow its content delivery system’s scale out. “We currently assign each ioDrive device-based server at least five times the load of our SAS-based hosts. As we continue our rollout, we see no reason why we shouldn’t be able to get to seven or eight times the workload.”

Going Green without Compromise

In addition to improving cache performance and positioning Pandora for growth, the SanDisk-powered system also allowed Pandora to cut costs in many areas.

Aaron said, “The SanDisk-powered servers provide NAND flash cache with order-of-magnitude higher capacities than that of RAM cache. This allows us to continue to support our growing listener usage on fewer, smaller, and less power-hungry servers.”

In fact, the SanDisk-powered servers delivered 1.28TB of Fusion ioMemory cache per server, allowing Pandora to reduce per-server RAM needs.

Aaron also told us that using the SanDisk-powered cache allowed Pandora to reduce its server footprint by about 40 percent—a move that resulted in an instant ROI on repurposed servers, lowered the content system’s power and cooling costs, and reduced maintenance overhead.

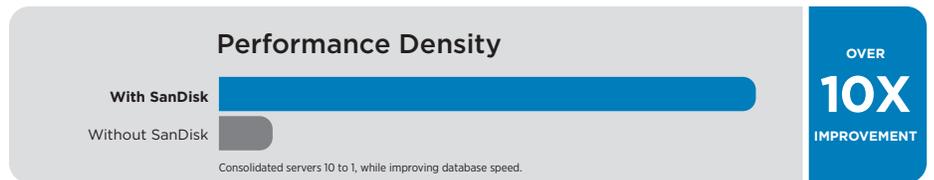
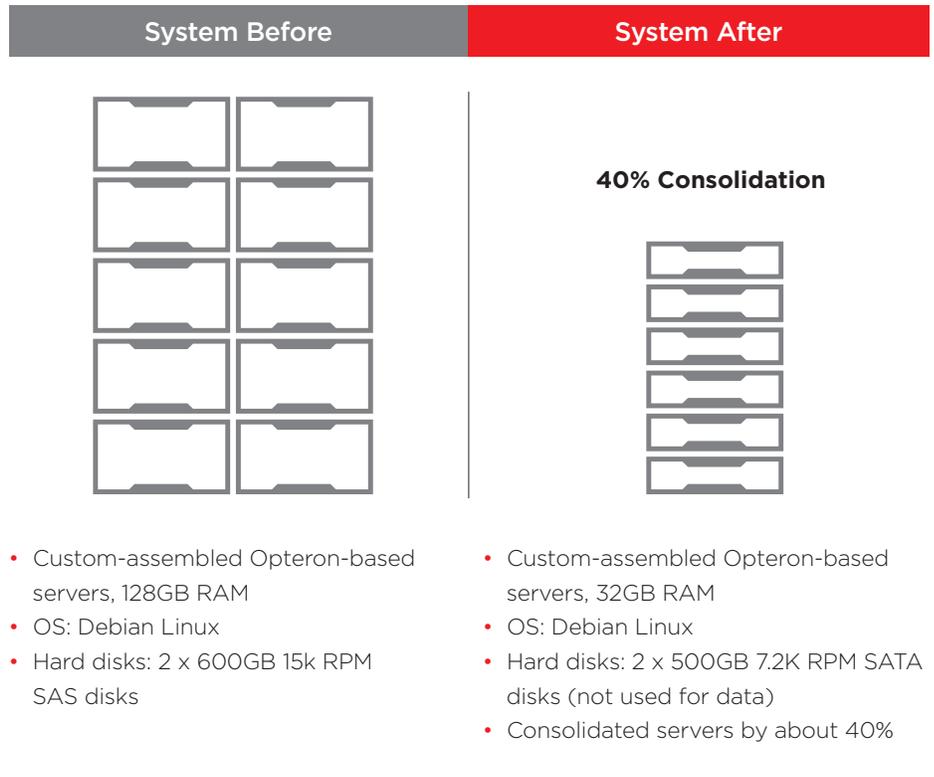
Aaron explained how moving data from hard disks to ioDrive cards resulted in a more efficient and overall cost-effective system: “We now store all the most frequently requested songs from our music archive on ioDrive cards. We have stopped using SAS spindles for content delivery, which has extended the usable life of our disk-based systems by months, if not years,” Aaron said. “In the first quarter that we’ve run them, the ioDrive cards allowed us to delay purchasing 50 disk-based content servers—at least 1,000 SAS spindles.”

Expert Solutions Support for a Simpler, Lower-Maintenance System

When asked about implementation, Aaron noted the benefit that the SanDisk team’s industry expertise provided. “It was immediately obvious that SanDisk had an understanding of our technology needs and were willing to work with us to put together a solution that met our particular environment’s needs.”

The SanDisk team worked with Pandora’s VAR to design and test the servers for physical layout and airflow. Pandora then worked directly with SanDisk support to determine the appropriate ioDrive formatting. Aaron’s team was also pleased with the reduced number of possible disk failures with the new system.

System Overview



Contact information

fusion-sales@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/enterprise

SanDisk®
a Western Digital brand

At SanDisk, we're expanding the possibilities of data storage. For more than 25 years, SanDisk's ideas have helped transform the industry, delivering next generation storage solutions for consumers and businesses around the globe.

Summary

Implementing Fusion ioMemory solutions gave Pandora the following benefits:

- **10x more** cache per server to enhance user experience
- **10x larger** overall cache to support future growth
- **7 to 8x** workload capability per server slows scale out spending
- **Replaces** larger, RAM-heavy servers with smaller, more power-efficient servers
- **40% smaller** server footprint
- **Eliminates** hard disks for frequently accessed content to greatly extend life of existing disk infrastructure and defer expensive disk upgrades
- **Open system** and **expert SanDisk staff** assists with designing optimal system with existing VARs and hardware partners

About Pandora

Pandora gives people music they love anytime, anywhere, through connected devices. (OK, we've added comedy as well so we're also up for playing some jokes you'll love.) Personalized stations launch instantly with the input of a single "seed"—a favorite artist, song or genre. The Music Genome Project®, a deeply detailed, hand-built musical taxonomy, powers Pandora's personalization using musicological "DNA" and constant listener feedback to craft personalized stations from a growing collection of hundreds of thousands of recordings. Tens of millions of people in the United States turn on Pandora to hear music they love.

The performance results discussed herein are based on internal Pandora testing and use of Fusion ioMemory products. Results and performance may vary according to configurations and systems, including drive capacity, system architecture and applications.

©2016 Western Digital Corporation or its affiliates. All rights reserved. SanDisk is a trademark of Western Digital Corporation or its affiliates, registered in the United States and other countries. Fusion ioMemory, ioDrive, and others are trademarks of Western Digital Corporation or its affiliates.