Santa Monica College Disperses Registration Flash Mob with Flash Memory

Education institution uses a single Fusion ioMemory™ ioDrive® card to deliver the performance of an expensive SAN upgrade

Solution Focus
- Oracle 11g
- Education

Summary of Benefits
- **100X** more enrollments per minute
- **Eliminates** login storm delays
- Oracle RAC performance at a
  fraction of the price
- **Immediate ROI**
- **Quick and easy** implementation

The Challenge

Santa Monica College (SMC) is a two-year, public community college with more than 34,000 students. It comprises six campuses, stretching from Santa Monica to Malibu. SMC leads California's 112 community colleges in the number of students transferring to four-year colleges.

SMC's challenge stems from California state budget shortfalls that have led to class reductions. SMC's available class seats have declined by one-third since 2008; at the same time, the number of people enrolling has increased. The database system SMC used for student enrollment held up well until 2009, when the class shortage began to create unprecedented demand during registration.

SMC has two enrollment periods—one structured and the other unstructured. Students register for classes on a structured schedule that distributed the database update workload over time. However, students who don't pay tuition by the due date lose their class registration, opening up hotly contested seats. These seats open at the exact time as the unstructured enrollment period begins, resulting in a login storm that often overwhelmed the system.

Lee Johnston, Director of MIS at SMC, described the problem: "Five minutes before classes become available to register, thousands of students login to compete for the open seats. It was kind of like a flash mob," Lee said. Login and enrollment require multiple database operations, so when the flash mob hit, it saturated the system. "Resource contention became so bad, students couldn't even add a class," Lee said. "There were times when this workload would shut the system down for three to four hours, resulting in "denial of services" notices for students trying to register. You can't even imagine the stress this caused students and parents."

SMC needed a system that could achieve the following:
1. Support 400-600 logins per second to eliminate login storm downtime
2. Relieve CPU contention to support 50,000 enrollments per hour
3. Be cost-effective
4. Be easy to implement

The SanDisk® Solution

Lee and his team determined that lowering latency was the key to delivering the high transaction performance the system needed to eliminate the login storms that resulted in denial of service. Having heard that SanDisk's Fusion ioMemory ioDrive products were known for low-latency performance, Lee and his team decided to add an ioDrive card to SMC's database server. The results exceeded their expectations.

Benchmarking the System

SMC had already addressed a bottleneck at its web tier with Citrix Netscaler, which increased its 5,000 simultaneous login capacity to over 50,000. However, this shifted the bottleneck to the database server I/O. "Once the web tier bottleneck was removed, it exposed the database tier to the full load for the first time. Even with a BL870 4P 16-core server rated at 800,000 TPM, the database server was not up to the task," Lee said. "We either needed to spread the I/O or radically decrease latency. But even with a super-fast 4GB Fibre Channel switch and SAN, latency caused excessive CPU blocking, and at peak loads, the system would cease functioning."

Lee's team benchmarked the SanDisk-powered database tier, using JMeter to generate a login and enrollment load against the database. The final test simulated 5,000 enrollments per minute. "The tests were conclusive—the ioDrive solution was a homerun," Lee said. "It reduced latency to the point that blocking CPU behavior was almost eliminated."

> *"We actually thought JMeter was broken," Lee said. "The first test didn't even register on the Oracle Enterprise Manager console, though the transactions completed as planned."*
>
> **Lee Johnston, Director of MIS and Co-Chairman of the District Technology Planning Committee, Santa Monica College**

Enrollments per Minute

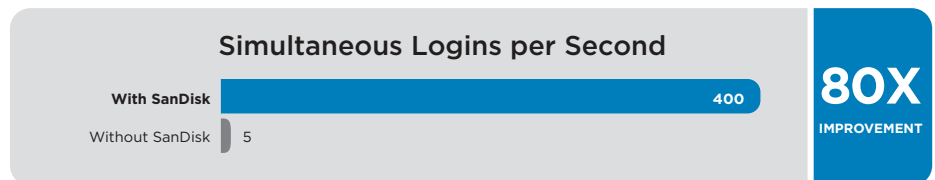|	
With SanDisk	833
Without SanDisk	8.33

100X IMPROVEMENT
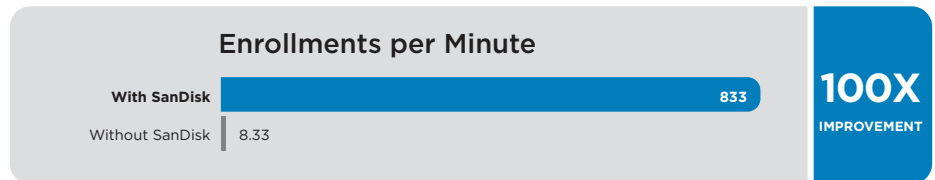
Scaling Simultaneous Logins for Today's Fast-paced Society

Login storms did more than just frustrate students trying to enroll; because all the schools applications accessed the database, productivity elsewhere slowed to a crawl during the flash mob login storms.

After seeing the ioDrive benchmarks, Lee was confident in the solution and installed a 320GB ioDrive card in SMC's production Oracle database server. The SanDisk-powered system proved itself in practice during the Fall 2012 semester's rush. Thousands of students logged into the system at once, but this time the system didn't stutter. "The harder we beat on the thing, the faster it went, which stunned us," Lee said. "We can now fully utilize Netscaler's simultaneous login capability."

> *"The harder we pushed the ioDrive card, the lower the actual latency went (below our ability to measure). The team was stunned at the ioDrive card's speed."*
>
> **Lee Johnston, Director of MIS and Co-Chairman of the District Technology Planning Committee, Santa Monica College**

Simultaneous Logins per Second

With SanDisk	400
Without SanDisk	5

80X IMPROVEMENT

SanDisk®
a Western Digital brand

Immediate ROI

Lee noted that SMC had other options for resolving its performance problems, but none were as cost-effective as SanDisk. "We were asked, why don't you go buy a faster SAN?" Lee said. "But that system's end-of-life was not for another couple years—that's hundreds of thousands of dollars for us. Another option was to go the Oracle RAC route, but that would have cost millions of dollars to operate."
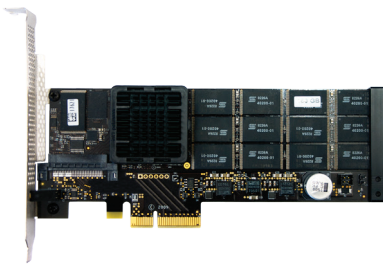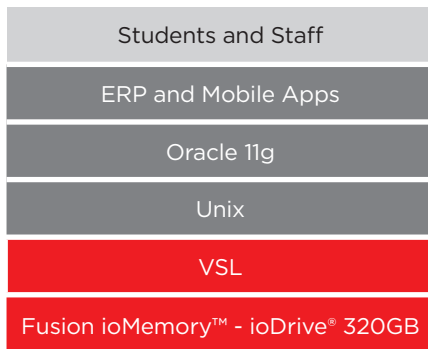
Lee said SMC received a "literally immediate" return on its investment in two ioDrive cards. Previously, the login storms were so severe that it cost SMC revenue and valuable staff time, which are many times the cost of the ioDrive products.

Quick and Easy Implementation

Unlike upgrading its SAN or implementing Oracle RAC, adding Fusion ioMemory products to SMC's database tier was quick and easy. "The installation was 30 minutes," Lee told us. "We just opened the server, stuck it in the mezzanine bay, and mounted it," Lee said. "It took less than five minutes to copy the 80GB database and miscellaneous files to the ioDrive card."

System Overview

SanDisk Powered Software Stack

Students and Staff
ERP and Mobile Apps
Oracle 11g
Unix
VSL
Fusion ioMemory™ - ioDrive® 320GB

Fusion ioMemory™ - ioDrive®

System Before	System After

Database Servers
- 1 x 1U blade server, 4P 16-core Intel Itanium 9340 processors, 256GB RAM
- OS: HP-UX 11i/V3 Virtual Server Environment VOS OE
- Database: Oracle 11g, Clean Address database instance
- Hard disks: 2 x 10K RPM SAS drives, 146GB

Storage
- 2 x 2U disk arrays (16 15K SAS drives in SAN)
- Hard disks: 2 x 300GB drives in RAID1

Database Servers
- 1 x ioDrive 320GB card added
- Moved database off SAN, onto ioDrive card

Summary

Implementing the Fusion ioMemory solution gave SMC the following benefits:

- 100X more enrollments per minute
- Eliminated login storm delays
- Oracle RAC performance at a fraction of the price
- Immediate ROI
- Quick and easy implementation

Lee is now looking at other areas in the college that could benefit from performance. "I think the next application for us is over in our Arts and Entertainment College," Lee said. "We have a film school and they are heavy into I/O."

About Santa Monica College

Santa Monica College—a two-year community college accredited by the Western Association of Schools and Colleges—opened in 1929 with just 153 students. It has now grown to a thriving campus with approximately 34,000 students and offerings in more than 80 fields of study. SMC prides itself on preparing students for careers of the 21st century—in such fields as nursing and health care, solar technology and other "green" careers, entertainment technology, computer technology, early childhood education, business, graphic design, and other occupations. SMC also brings the best of public radio to Southern California through the award winning college station KCRW (89.9 FM).

"The ioDrive cards were a far better value. Cost and complexity are radically lower with SanDisk."

Lee Johnston, Director of MIS and Co-Chairman of the District Technology Planning Committee, Santa Monica College

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