Accelerating Oracle with TurboBoost™ Enhanced Caching Hard Drives

Technical Brief

Challenge

Adequately support mission-critical transaction processing and decision support for one of Seagate's major high volume hard drive manufacturing facilities.

Solution

Seagate® Enterprise Performance 15K HDDs with TurboBoost enhanced caching feature.

Benefits

A hybrid solution, such as the Enterprise Performance 15K HDDs with TurboBoost, costs less, delivers comparable—if not better—performance, and provides 2× the raw storage capacity shows a compelling advantage over SSD-only solutions, especially in Oracle DB server environments.

To Learn More:

Enterprise Performance 15K HDD with TurboBoost

For more information about TurboBoost™ and its application in an Oracle DB server environments, visit http://www.seagate.com/internal-hard-drives/enterprise-hard-drives/hdd/enterprise-performance-15k-hdd/

Seagate manufacturing facility in Thailand discovers strong performance and cost benefits using hybrid hard drives for mission-critical, server-based Oracle applications

Korat, Thailand is the location of one of Seagate's major high volume hard drive manufacturing facilities, producing up to several finished devices every second when operating at peak levels.

The demands placed on the technological infrastructure that enable such high volume output are intense, requiring exceptional levels of speed and reliability. An Oracle database server system handles mission-critical transaction processing and decision support, but the facility's IT department found that the system was no longer able to deliver the level of performance needed. That is, the hardware could no longer efficiently handle the continually increasing demands being placed on it as the factory's output and backend needs scaled over time.

Following the decision to upgrade, and after initially installing exclusively solid state drives (SSD), the IT department experimented with Seagate® Enterprise Performance 15K hard drives with TurboBoost, which use a combination of traditional magnetic media and solid state NAND flash storage for caching.

The team found that the hybrid solution delivered not only a significantly improved cost-benefit ratio compared to the all-NAND SSD solution, but also outperformed it in certain circumstances, with the extra advantage of additional storage capacity for future growth.

IT Challenges in High-Volume Manufacturing

At the heart of the facility's system is a set of Oracle applications and database storage running on a mainframe subsystem along with 13 servers sharing a total of 14TB. The system accommodates the specific needs of the production line and fulfils specific tasks, especially transactional processing, decision support and analytics—increasingly common and necessary applications across the manufacturing world.

Transactional processing involves tracking incoming and outgoing inventory, purchasing, shipping and sales. Decision support and analytics applications provide actionable data that allow management to optimize the manufacturing process and ensure the peak performance of the facility, now and in the future.

The database needs to be able to respond swiftly to a high number of random inquiries at loads of up to 20,000 IOPS (Input/Output Operations per Second). Seagate's problem rested in its Oracle platform no longer being able to reach these performance levels.

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Hitting the Limits of Database Performance

The IT department identified that its Oracle Database Appliance x86 server was unable to deliver the level of performance the facility needed. "They were out of performance capacity. The system could no longer support the transaction rate they needed to support the manufacturing," explains Dave Anderson, enterprise storage technologist at Seagate.

More precisely, the system could not run all of the simultaneous processes required. "In a practical sense, what happens is some applications just cannot run," notes Anderson. "They want to run an analysis on a particular aspect, but the system is so busy with the individual transactions supporting production that they can't."

On inspection of the database processes, the IT team identified a 60% write ratio, mainly based on the workload characteristics of the sytem's OLTP (online transaction processing) operations. As a result, the system's cache was optimized for write operations, but this slowed down the decision support system. Overall, the configuration clearly suffered when confronted with the mixed use requirements of Seagate's Oracle implementation.

Upgrading to Hybrid Solution

Seagate's IT team in Korat made the decision to upgrade, but rather than simply go for a larger shared subsystem and bigger servers within the existing infrastructure, the team chose to develop its own custom solution with 19 individual database appliances.

The application of software-defined storage principles to mission critical storage neatly solved the performance capacity problems inherent in the previous system. Whereas some servers had housed multiple databases, the ground-up change gave the team an opportunity to rethink its storage strategy.

The group initially populated one of the new database servers with 16 800GB Seagate® 1200 SAS SSDs, which delivered predictably excellent performance. However, SSD drives represent a very high capital investment. Could a more cost-effective solution be found that would provide similar performance results for less money? This inspired the team to experiment with a hybrid solution, using Seagate Enterprise Performance 15K HDDs with TurboBoost technology, which combines SSD and HDD storage technologies.

Whereas each SSD uses only NAND storage media, the Enterprise Performance 15K HDD complements its 600GB of magnetic media with 128MB of NAND to handle small but high-volume transactional tasks. In terms of per-gigabyte costs, the Enterprise Performance 15K HDD was clearly the better choice, but could only 128MB of NAND per drive hope to compete against 800GB on performance?

Benchmark test results amazed everyone. The hybrid TurboBoost solution performed at near-parity with its all-SSD counterpart and actually outperformed the all-SSD configuration in some database transaction scenarios.

The two systems achieved near-identical write response times. Read response times clocked in at 0.5ms for the SSD solution, and only 0.8ms for the TurboBoost solution. Single transaction submission rates were also comparable, with 11.6K single submissions per minute for the TurboBoost solution compared to 14.1K for the SSDs. However, on batch submissions, TurboBoost outperformed SSD, delivering a batch submission speed of 11.8K per minute versus 11K per minute, respectively.

Conclusion

The full extent of the advantages of the hybrid solution over SSD became apparent when the team analyzed the performance-cost ratios. Taking into account all cost points, TurboBoost delivered up to 3× the capacity, 34% greater performance on single data submissions, and a very impressive 75% higher performance on batch data submissions for every dollar spent compared to the more expensive all-SSD approach.

"There was a huge benefit," says Anderson. "They reduced the cost of the equipment by over 60%, had up to 7× better performance, with up to 10× the capacity."

Upgrading the core IT infrastructure at the Korat facility is an expensive undertaking, and mid- to long-term growth potential is just as important as the short-term performance boost. To that end, a hybrid solution using the Enterprise Performance 15K HDDs with TurboBoost can cost less money and deliver comparable—if not better—performance. It provides 2× the raw storage capacity and shows a compelling advantage over SSD-only solutions.