Benefits of NetApp Flash for Database Workloads

Portfolio of Innovation

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1 Overview

Flash storage technologies are having an immediate impact on how storage and applications are designed to achieve optimal performance. This document provides highlights of and advantages to customers' Oracle® Database environments when using some of the many choices of flash technology offered within the NetApp® flash portfolio.

1.1 Introduction

The NetApp flash portfolio is capable of solving database performance and I/O latency problems encountered by many database deployments. The majority of databases have a random I/O workload that creates a problem typically solved by increasing the amount of spinning media.

Many customers are required to deliver improved performance and increase efficiencies while still being able to maintain an enterprise-class infrastructure. NetApp provides an enterprise-class flash portfolio consisting of flash in the storage controller (Flash Cache™ intelligent caching), flash within the disk shelves (Flash Pool™ intelligent caching), and all-flash arrays. This portfolio can be used to solve complex database performance requirements at multiple levels within a customer's environment.

With this technology, customers can gain significant performance improvements for their Oracle Database workloads when spinning media does not provide the necessary latency for those applications. The level of improvement produced by any solution depends upon many variables and the characteristics of the workload.

1.2 Advantages

By deploying flash storage, customers can dramatically improve the response times delivered to the applications that depend on Oracle Databases while at the same time reduce power, cooling, and floor space requirements. This means that more business can be done, more customers can be served, and more solutions can be delivered for less money than would be required with traditional storage infrastructures.

Because NetApp offers multiple flash technologies along with our other storage systems, we can tailor a solution to meet a wide variety of customer requirements.

2 NetApp Flash Array

2.1 Business Problem

A NetApp EF flash array solution was designed to meet the following requirements for a database supporting a critical business application.

1. Significantly increase the I/O performance of an Oracle Database to support an OLTP workload.
2. Support specific requirements of low-millisecond latency for the random I/O workload on business-critical applications with an Oracle Database.
3. Provide the high-performance throughput required by the application and line of business. Business processes needed to complete in less than five hours

2.2 Solution Overview

The solution was to deploy four NetApp EF flash array controllers in two data centers for the database infrastructure. This allowed each data center to achieve a potential of 600K IOPS.
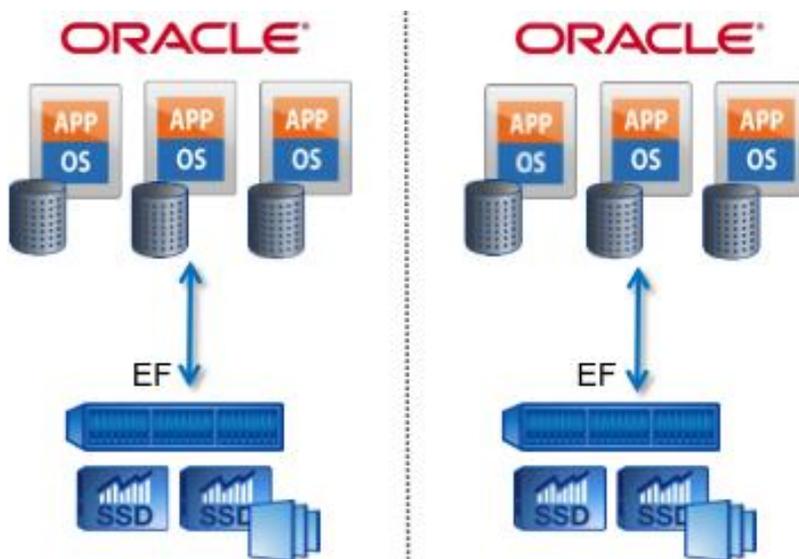

Figure 1) HA EF flash array in two data centers.

2.3 Results and Observations

The customer database storage infrastructure was able to service a high-performance I/O with submillisecond latency with the NetApp EF flash array. The following results were identified.

1. There was a highly available storage environment of the core applications and database workloads.

2. Application jobs completed in 2.3 hours, down from 5.6 hours.
3. Application and read response times went down to submillisecond latency. They achieved .86ms read latency, down from 10ms.
4. The customer gained the capability to process one million records in 50% less time.
5. Backups completed in 75% less time.

2.4 Benefits to the Business

This infrastructure allowed the customer to achieve submillisecond latency for high-performance workloads produced by business-critical applications. The customer is now capable of growing its processing due to the reduction in latency and the capability to process more records in less time.

3 NetApp Flash Cache

3.1 Business Problem

An Oracle Database supporting a data warehouse application needed to drastically improve the performance of specific batch processing jobs and read latency with minimal investment in the infrastructure.

1. A specific batch report took 72 hours to complete.
2. Read latency was above 10ms.

3.2 Solution Overview

The solution for this problem was to deploy Flash Cache in a current NetApp FAS infrastructure. Since NetApp storage was already within the infrastructure, the problem could be resolved quickly. The decision was made to deploy the appropriate Flash Cache system to solve this specific performance problem fast and cost effectively.
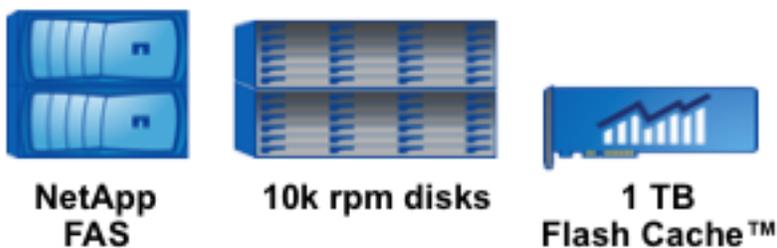

NetApp FAS   **10k rpm disks**   **1 TB Flash Cache™**

Figure 2) NetApp FAS with Flash Cache.

3.3 Results and Observations

The solution to this problem was to deploy Flash Cache in the customer's current NetApp FAS infrastructure. Because NetApp storage already existed within the infrastructure, the business problems could be quickly resolved.

The following are the results of the use of Flash Cache within this environment.

1. Batch processing was reduced from 72 hours to 24 hours.
2. Read latency was reduced from 10ms to 1.5ms.
3. Performance of this workload was improved seven times with Flash Cache.
4. Consistent and improved throughput with fewer physical disk reads resulted for the application workload. The Flash Cache solution was able to meet and service a significant increase in data requests.
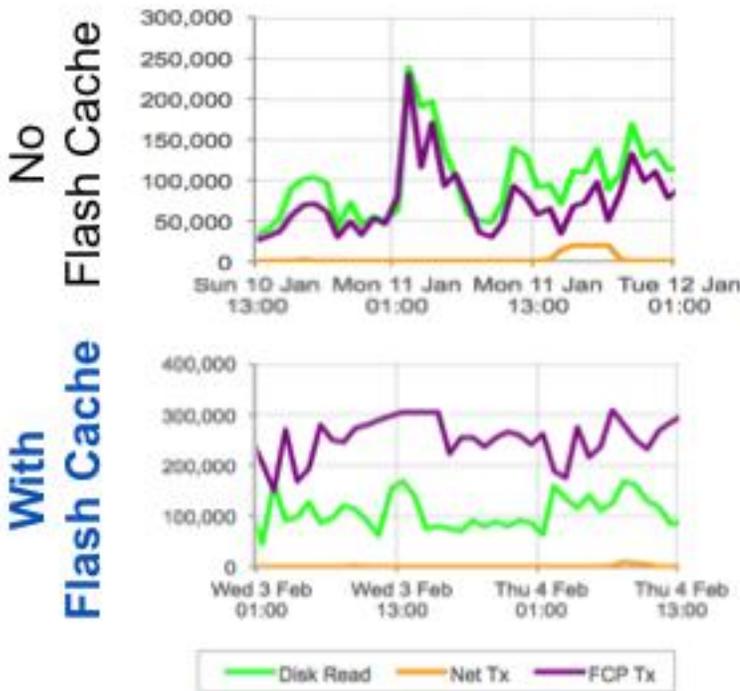

Figure 3) Physical disk read comparison.

3.4 Benefits to the Business

The use of Flash Cache in this environment quickly resolved the customer's problem of getting the specific batch report out of the data warehouse database in a timely manner. It also improved read latency by almost seven times over prior performance without Flash Cache.

4 NetApp Flash Pool

4.1 Business Problem

The problem was to reflect the impact of Flash Pool on a storage infrastructure servicing an Oracle workload. The Oracle Database characteristics included an OLTP random read/write I/O workload. The challenges were to:

1. Reduce the I/O latency from 17ms.
2. Improve throughput.

4.2 Solution Overview

The solution for this problem was to deploy Flash Pool using 22 SSDs. This environment consisted of a NetApp FAS6240 with 80 15K RPM disk drives along with the 22 SSDs.

FAS6240 HA   **80x**   **22x Data**
              15K rpm disks   **SSDs**
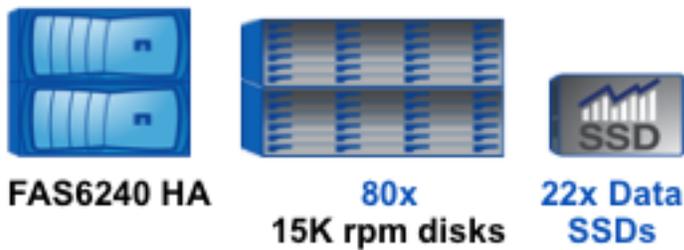
Figure 4) FAS6240HA with Flash Pool.

4.3 Results and Observations

The results of using Flash Pool for this database OLTP random-I/O workload were the following.

1. There was a 30% decrease in database I/O latency. The latency was reduced from 17ms to 5ms.
2. There was a three-times increase in throughput for the OLTP workload.
3. 88% of read operations came from cache.
4. The improvements enabled a reduction in required HDDs and let the customer still meet the demands of I/O. They also enabled a reduction in the data center footprint.
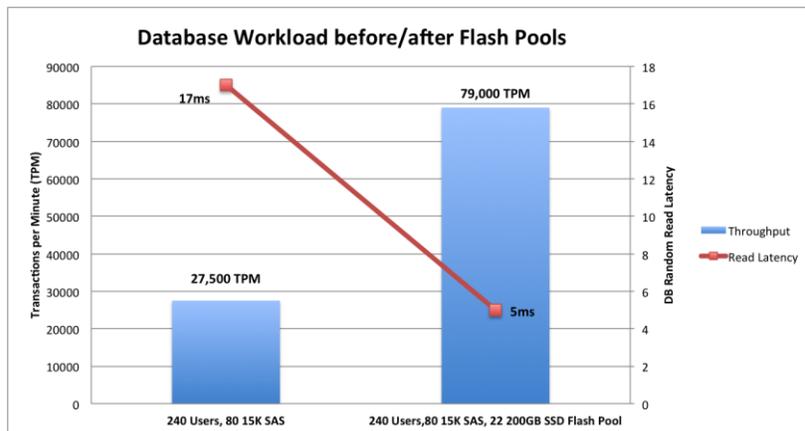
4.4   Benefits to the Business

The use of Flash Pool for random I/O workloads allowed the customer to not only gain in throughput, but to meet the demands of high-performance requirements. This solution provided a 30% reduction in latency and the capability to increase throughput by three times.

Another benefit was reducing the traditional spinning spindle count and still being able to meet the requirements of a demanding OLTP workload. Reducing the spinning media also reduced the power and cooling requirements.

5   Summary

With a wide variety of flash storage offerings and a depth of Oracle Database expertise, NetApp is well positioned to design and implement the right solution for customers experiencing I/O bottlenecks. When these solutions are implemented properly, customers can improve their speed of transactions; reduce wait times for users; and lower power, cooling, and floor space requirements.