



UTILIZE VEXATA WITH FLASH CACHE TO BOOST ORACLE DATABASE PERFORMANCE



Maximize Oracle Database Smart Flash Cache with Vexata NVMe Flash Array

Oracle workloads, especially Online Transaction Processing (OLTP) environments can many times overwhelm the Input Output (I/O) operations processing capabilities of the underlying infrastructure. When this occurs, in most cases the I/O bottlenecks can be root-caused back to the underlying storage array. This directly impacts the transaction throughput as well as the application response time which directly impacts the customer experience.

In order to take advantage of the development of NVMe solid-state technology, there is a feature that exists within Oracle Database called Database Smart Flash Cache, that allows the ability to extend the dedicated shared memory area in main memory called System Global Area (SGA) beyond the main memory to an external flash device. The primary benefit of Flash Cache is that it significantly boosts the performance of Oracle database without the need to replace the production storage system.

What is Oracle Database Smart Flash Cache and When Should it Be Used?

The Database Smart Flash Cache (Flash Cache) feature is best oriented towards workloads with repeated short transactions where many users access the same data, storage systems with intensive disk read activity and systems under heavy memory pressure that prevents more memory being allocated to the SGA buffer cache. As a result, this feature primarily benefits read-intensive workloads.

Oracle Flash Cache uses a networked storage environment to extend the SGA buffers from memory into flash via an external all-flash storage device, in this case, the Vexata VX-100 over a 32Gbps Fibre Channel Network.

As shown in Figure 1 below, data blocks brought into SGA on read requests and remain there until it ages out. Oracle database always keeps the latest buffers in the SGA up to the available capacity. Aged out buffers from the SGA will be written into Vexata VX-100 storage flash cache destination (volumes). When the database gets new read requests, it first checks the buffers availability at SGA, if not found then checks at VX-100 Flash cache destination before sending a request to the slower storage. VX-100 NVMe volumes provides much lower latency, approaching that of DRAM without the additional investment of DRAM.

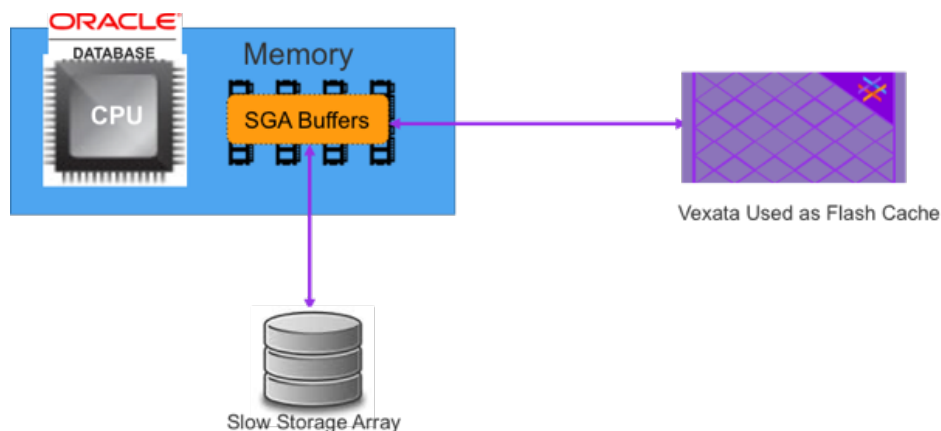


Figure 1: Vexata VX-100 Configured as Flash Cache

About Vexata: Vexata, a StorCentric Company, was founded on the premise that every business is challenged to deliver cognitive, data-intensive applications, Vexata delivers 10x performance AND efficiency improvements at a fraction of the cost of existing all-flash storage solutions.

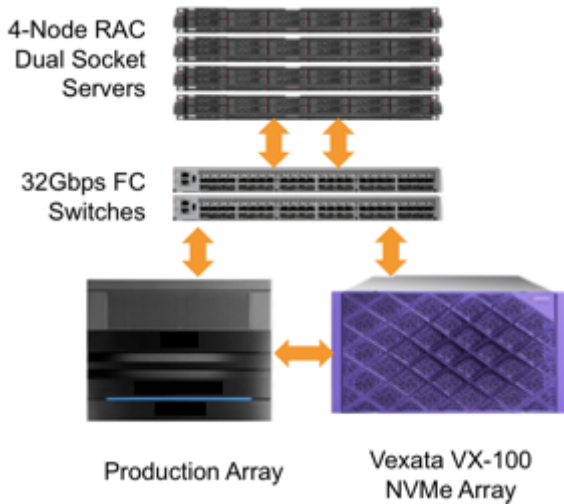


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Test Configuration

Database Smart Flash Cache works in all type of Oracle database configurations (standalone, cluster etc.) that run Oracle Linux and Solaris OS platforms that support Flash Cache. In order to illustrate the performance advantages of running Oracle Database Flash Cache with Vexata, the following RAC configuration was used for a 5TB Oracle database:



Server Configuration:

4 node Oracle RAC, 2x Intel Xeon (Skylake) CPUs (28 cores/socket), 512GB of RAM with 2x dual port 32Gbps FC HBAs. Oracle Linux 6.8, Oracle Grid Control and Oracle Database 12.2.01 with Oracle Enterprise Manager Cloud Control 13c.

Network and Storage Configuration:

The Vexata VX-100F was configured to support max performance and connected to the Oracle RAC cluster via 32Gbps ports using a Brocade G620 48 port Fibre Channel switch.

Figure 2: Oracle 4 node RAC Configuration

In order to enable the Flash Cache parameters on the Oracle RAC cluster, the following commands should be entered for each instance in the cluster:

```
Alter system set DB_FLASH_CACHE_FILE = 'Disk1/File1, Disk2/File2';
Alter system set DB_FLASH_CACHE_SIZE = 1T, 1T SCOPE=SPFILE;
```

For the Flash Cache parameters to take effect, stop and restart the database and validate the Flash Cache configuration is enabled on all 4 RAC nodes:

```
SQL: Show Parameters 'db_flash_cache%';
```

The above command will return the following values for each of the 4 RAC nodes:

NAME	TYPE	VALUE
db_flash_cache_file	string	+FLASHCACHE/host31.dbf
db_flash_cache_size	big integer	1T

Optionally, key Tables and Indexes can be pinned to remain in Flash Cache by using the KEEP option as shown:

```
Alter table schema_name.table_name STORAGE (FLASH_CACHE KEEP);
Alter index schema_name.index_name STORAGE (FLASH_CACHE KEEP);
```



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To validate the Database Smart Flash Cache feature, a 5TB Oracle Database was tested using a SLOB (Silly Little Oracle Benchmark) workload on the 4 node Oracle RAC with a slower SAN storage as the main source for data destination and Vexata VX-100F Flash Array LUNs as Database Smart Flash Cache destination. The workload simulated an environment where multiple concurrent DB users submitted transactions against a database. Under heavy load, the large number of concurrent transactions generated a significant number of I/O operations to the storage sub-system.

The test results captured in Figure 3 below shows performance when the workload was I/O bound (meaning that application throughput was limited by the number of I/Os that could be processed by the array subsystem).



Figure 3: Initial SLOB Read I/O from Production Array

As shown in figure 4, Database Smart Flash Cache was introduced and increased, writes were initiated into Vexata Flash Array and the throughput increased as the read I/O comes exclusively from the Vexata Flash Array.



Figure 4: Writes to Database Smart Flash Cache (Vexata)



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Viewing the Oracle Enterprise Manager, you can verify that as the Flash Cache warms up, the subsequent reads are coming directly from the Vexata array and the total read throughput has increased by more than a factor of 6X increasing reads from about 3.4 GiB/s (3.7 GB/s) to over 18.7 GiB/s (20.1 GB/s).

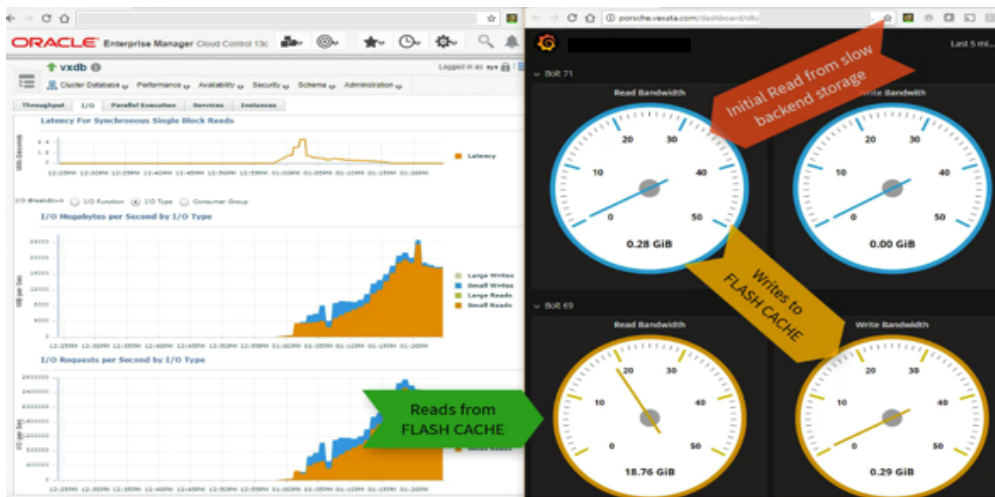


Figure 5: Performance with Flash Cache enabled via Vexata

Conclusion

When used with Vexata NVMe Flash Storage Arrays, the Database Smart Flash Cache feature within Oracle Database can significantly impact application throughput for workloads that are I/O bound, particularly intensive read or read-only workloads. It should be noted that the performance measurements cited here are only a fraction of the potential performance that can be achieved by the Vexata system and could have also been achieved on a 16Gbps Fibre Channel network. It should also be noted that while Database Smart Flash Cache reduces physical reads, it also benefits writes because it reduces the load on the disks caused by reads, therefore leaving more IOPs available for write I/O.

Available within Oracle Database at no additional cost, Database Smart Flash Cache on Oracle Solaris and Oracle Enterprise Linux has the potential to offer considerable benefit to Oracle Database users through the simple, low-risk addition of Vexata NVMe flash systems.

Vexata is now offered by Nexsan. sales@nexsan.com