Abstract

This white paper examines the performance considerations of placing SAP applications on FAST Cache-enabled EMC® unified storage. It also discusses the best practices for deploying SAP applications using EMC FAST Cache technology.

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Executive summary

The business challenge that many SAP customers face today is reducing total cost of ownership (TCO) while improving service level delivery. Frequently, responsiveness to sensitive SAP applications has deteriorated over time due to increased data volumes, unbalanced data stores, and changed business requirements. By using EMC’s latest FAST Cache technology on EMC® unified storage with block data, SAP deployments under performance pressure can often gain a significant responsiveness boost without the need to redesign the applications, adjusting the data layouts and/or reloading significant amounts of data. EMC FAST Cache technology leverages the use of Flash drives to add an extra layer of cache using Flash drives between Dynamic Random Access Memory (DRAM) cache and rotating spindles, which increases the I/O service responsiveness. The SAP application’s hot and cold data is automatically identified and hot data is cached by this newly created cache layer on Flash drives. FAST Cache technology provides very low latencies to frequently accessed data, thus improving the overall application response times. By focusing the use of Flash drives toward the most frequently accessed data, the investment made toward the Flash drives is leveraged to the most optimal extent to deliver a magnitude of application service improvement. As the focus of business changes, the data that becomes the most important, and most frequently used, will be automatically cached in these Flash drives. Hence, the business applications will always be taking full advantage of the investments made in these Flash drives, delivering optimal application service improvement. The performance improvements gained by using FAST Cache technology in SAP deployments provide a tangible and quantifiable operational cost savings over time.
This white paper is intended for SAP administrators, storage architects, customers, and EMC field personnel who want to understand the implementation of FAST Cache technology in SAP environments to improve the performance of business applications.

Introduction

This white paper provides insights into how using FAST Cache technology in an SAP deployment with data stored on an EMC unified storage system can improve performance, based on an engineering case study conducted by EMC that used an SAP system on EMC CLARiiON® CX4 storage arrays using FAST Cache technology. This white paper also covers the workload experiments that EMC conducted with an SAP ECC 6.0 system using storage pools. The goal is to verify that using FAST Cache can boost performance and reduce TCO for certain kinds of SAP applications when used along with traditional LUN-based technology. EMC tested these differences by comparing both in transaction rates per minute as well as transaction response times without requiring application-level changes and without changing the application design, code, and logic. The findings from these experiments serve as the basis of
some of the deployment best practice recommendations for leveraging FAST Cache technology in different SAP environments. Skip to the System hardware setup section if you are already familiar with EMC storage, EMC FAST Cache technology, and the SAP ECC (ERP Central Component) system.

EMC and SAP technology

EMC CLARiiON CX4

The EMC CLARiiON CX4 series with UltraFlex™ technology is based on extensive technological innovation, providing a very competitive midrange storage solution. CX4 is the fourth-generation CX™ series and continues EMC’s commitment to maximizing customer’s investments in CLARiiON technology by ensuring that existing resources and capital assets are optimally utilized as customers adopt new technology.

CLARiiON CX4 systems support the latest generation of disk drive technologies like Flash drives, 4 Gb/s Fibre Channel drives for high performance, and SATA II for high capacity. CLARiiON CX4 is the first midrange storage system to support all of these types of disk drive technologies. The CLARiiON CX4 with the latest FLARE® release 30 has been optimized for maximum performance and tiered storage functional flexibility. CLARiiON CX4 systems also benefit from the advanced capabilities that EMC software provides, including local and remote replication, Unisphere™ Quality of Service Manager, and five 9s availability. A complete introduction to the CX4 series is beyond the scope of this document. A few major features of the CLARiiON CX4 series are listed in the figure. All four models of the CLARiiON CX4 listed support FAST Cache technology.

Figure 2. EMC CLARiiON CX4 models
**EMC Celerra unified storage**

EMC Celerra® unified storage platforms combine an IP storage enclosure and best-in-class, native CLARiiON storage, providing NAS, iSCSI, and Fibre Channel in a single packaged solution. Having built on a robust platform like CLARiiON, Celerra unified storage inherits all the high-availability (like five 9s) characteristics of a CLARiiON storage platform along with support for almost every latest technology available on a CLARiiON storage platform. The EMC unified storage platform also supports all the latest generation of disk drive technologies including Flash, Fibre Channel drives, and SATA II drives.

<table>
<thead>
<tr>
<th>Unified Storage</th>
<th>Dedicated storage</th>
<th>Easy to deploy</th>
<th>Simple to manage</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS-120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NS-480</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NS-960</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Availability</th>
<th>Failover</th>
<th>Advanced Failover (N+1/N+M)</th>
<th>Advanced Failover (N+1/N+M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of X-Blades</td>
<td>1 or 2</td>
<td>2 or 4</td>
<td>2–8</td>
</tr>
<tr>
<td>Connectivity</td>
<td>NAS, MPFS, iSCSI, Fibre Channel</td>
<td>NAS, MPFS, iSCSI, Fibre Channel</td>
<td>NAS, MPFS, iSCSI, Fibre Channel</td>
</tr>
<tr>
<td>Storage</td>
<td>CLARiiON</td>
<td>CLARiiON</td>
<td>CLARiiON</td>
</tr>
<tr>
<td>Maximum usable IP storage capacity (X-Blade/system)</td>
<td>32 TB/64 TB</td>
<td>64 TB/192 TB</td>
<td>128 TB/740 TB</td>
</tr>
</tbody>
</table>

**Figure 3. EMC Celerra unified storage models**

Most of the data points discussed in this paper are in the CLARiiON CX4 context but still apply to the native block implementation of any Celerra unified storage platform.

Both the CLARiiON and Celerra unified storage platforms provide the new Unisphere management software for storage management and administration. This suite of tools allows centralized management of storage systems. Unisphere provides a centralized tool to monitor and configure CLARiiON storage. The Unisphere suite includes Unisphere Manager, which has a web-based UI, and Unisphere Secure CLI or Command Line Interface. The Unisphere management tool also provides functional capabilities like point-in-time local replicas and remote replication options for business continuity.

**EMC FAST Cache technology**

In traditional storage arrays, DRAM caches are too small to maintain the hot data for long periods of time. Very few storage arrays give an option to nondisruptively expand DRAM cache, even if they support DRAM cache expansion. FAST Cache technology
Using EMC FAST Cache with SAP on EMC Unified Storage

builds a faster medium that acts as a cache for data on Flash drives, thereby allowing the hotter data to stay longer on a faster medium. These Flash drives, also known as solid state drives (SSD), are especially well suited for latency-sensitive applications that require consistently low read/write response times. FAST Cache tracks the data activity temperature at a 64 KB chunk size and promotes the chunks to the Flash drives once its temperature reaches a certain threshold. After a data chunk gets promoted to FAST Cache, the subsequent accesses to that chunk of data will be served at Flash latencies. Eventually when the data temperature cools down, the data chunks get evicted from FAST Cache and are replaced by newer hot data. FAST Cache uses a simple Least Recently Used (LRU) mechanism to evict the data chunks.

A complete introduction to FAST Cache technology is beyond the scope of this paper. For more details, reference the white paper **EMC CLARiiON and Celerra Unified FAST Cache - A Detailed Review**. Briefly, FAST Cache is built on the premise that the overall applications' latencies can improve when most frequently accessed data is maintained on a relatively smaller sized but faster storage medium like Flash drives. FAST Cache technology identifies the frequently accessed data and moves it to Flash drives automatically and nondisruptively. The data movement is completely transparent to applications, thereby making this technology application-agnostic and management-free. For example, FAST Cache can be enabled or disabled on any LUN/pool simply by selecting the LUN/Storage pool property in Cache settings.

The LUN/pool-level granularity enables FAST Cache to be selectively enabled on a few LUNs/pools within a storage array depending on the application performance requirements and SLAs.

There are several distinctions to EMC FAST Cache technology:

- It can be configured in read/write mode, which allows the data to be maintained on a faster medium for longer periods irrespective of application read-to-write mix and data rewrite rate. FAST Cache can also be configured in read-only mode depending on the application I/O read/write mix.

- FAST Cache can be created in different sizes, depending on the storage system model, and number and size of Flash drives installed on the system. For more information, refer to **EMC CLARiiON and Celerra Unified FAST Cache - A Detailed Review**.

- FAST Cache is created on a persistent medium like Flash drives that can be accessed by both storage processors. In the event of one storage processor failure, the surviving storage processor can simply reload the cache rather than repopulating it from scratch by observing the data access patterns, which is again a big differentiating point.

- Creating FAST Cache is completely nondisruptive. It is as simple as selecting the Flash drives that are part of FAST Cache and would not require any array disruption or downtime.

- FAST Cache is created on external Flash drives and is not going to consume any extra PCI-E slots inside the storage processor.
SAP

SAP has helped customers automate their business processes through the use of its standard Enterprise Resource Planning (ERP) software solution, called SAP R/3. The ERP solution was upgraded and launched as SAP ECC 6.0 in 2005. The purpose of positioning it as ECC (or ERP Central Component) is to enable SAP to build and develop an environment of other products that can function on the foundation of the central component. ECC has the components of the traditional R/3 finance, logistics, sales, material management, human resources, and additional extension sets. Individually, each module effectively serves to manage a business area or functional area for which a particular business unit is responsible. SAP NetWeaver is SAP’s integrated technology platform and is the technical foundation for all SAP applications.

The standard NetWeaver 7.0 business suite includes many systems that perform different activities. Each system is a separate SAP instance. However, the technical architecture of each system uses the same kernel architecture. The data that is imported into each system’s database during installation is what makes it different. The difference between these NetWeaver products comes strictly from the type of data imported into these systems rather than the general architecture. This is also true with the rest of the NetWeaver Suite applications (CRM, SRM, and BI).

Typically SAP systems are deployed in two-tier or three-tier configurations. In a two-tier configuration, the application and database run on one physical server and the distributed presentation clients access the SAP system using client tools like SAP GUI. In a three-tier configuration, the database and central instance run on one powerful server while multiple application servers run on different machines and distributed presentation clients access the SAP system using client tools.

Importance of storage performance in SAP

The production SAP system can generate quite large volumes of data that need to be accessed with low response times for online users as well as background batch-processing jobs. The design of a database server’s storage system is one of the most important choices in the design of the SAP infrastructure. A properly designed disk storage system has direct influence on the response times of the overall SAP landscape and instances. Typically, in the case of production SAP systems, the size of all the database files combined is significantly larger than the size of the physical memory (RAM) available, whether on the server or on the storage cache. Since most servers today do not support hundreds of gigabytes of physical memory, the data transfer to or from storage plays a crucial role in the overall performance of the SAP system.

Disk I/O patterns from the business application perspective

The number and type of hard disk drives have a considerable influence on the performance of disk I/O. In addition to the capacity requirements, the SAP system requires performance from the storage system in the form of high I/O throughput. Online Transaction Processing (OLTP) applications create millions of random disk
accesses (usually 8K blocks for SAP databases). For SAP R/3 systems, the database server has a typical OLTP disk I/O access profile of an 80/20 percent read/write (4:1) ratio. Depending on the components you use and the customizations you make to the SAP system, other ratios are also possible. For example if you want to import large amounts of data in batch mode, the read ratio is more when compared to the write ratio where the storage system may need to be configured differently.

Online Analytical Processing (OLAP) systems such as SAP Business Information Warehouse (BW) or SAP Advanced Planner and Optimizer (APO) usually transfer large data quantities. For instance, user-generated BW queries and reports are extremely read-intensive and disk performance is the key for these kinds of operations. So the 80/20 percent read/write ratio does not necessarily apply to the BW system.

You can characterize the disk I/O performance as the number of I/O (read/write) operations that a hard disk can perform per second (IOPS). Disk arrays are used for production systems to perform several I/O operations concurrently. For our study we have used storage pools with FC, Flash, and SATA II drives configured as RAID 5 in EMC’s CLARiiON CX4-960. For better performance and the best failure protection, EMC recommends using RAID 1/0. In some cases, RAID 1/0 offers faster data reads and writes than RAID 5 because it does not need to manage parity.

Traditionally these OLTP applications are deployed on a huge number of rotating Fibre Channel spindles (a process known as short-stroking) to meet the low I/O latency requirement. So, when OLTP applications are deployed on a huge number of rotating spindles, the effective capacity utilization of these spindles is very low, thereby increasing TCO. Disk drive technology has not evolved as much as CPU technology over the past few decades. Even the fastest rotating spindle with a 15k rpm speed performs only around 200 random 8K IOPs practically in most real world application workloads. Flash drives are a disruptive technology with no rotating componentry that significantly improves IOPS/$ but comes at a relatively higher $/GB cost. FAST Cache technology creates a faster intermediate medium for storing the frequently accessed data on Flash drives. This significantly reduces the need to buy more Flash drives while at the same time providing Flash latencies to frequently accessed data.

**SAP Application Performance Standard**

The SAP Application Performance Standard (SAPS) is a hardware-independent unit that describes the performance of a system configuration in the SAP environment, which is derived from the SAP Sales and Distribution (SD) benchmark. SAP standard benchmarks are geared more toward measuring the CPU and the memory of a hardware system based on a customer’s SAPS requirement. SAP standard application benchmarks are not I/O-intensive in nature and do not generate the required I/O load to compare and contrast SAP system performance using FAST Cache at the storage layer. Therefore, EMC has internally developed custom SAP OLTP workloads that are based on real customer data and can generate the I/O load for our engineering study purpose.
System hardware setup

To characterize FAST Cache with SAP OLTP workloads, EMC used the following hardware setup. The performance study is done on an SAP ECC 6.0 system running on SUSE Linux Enterprise Server 10 using a single instance of an Oracle 10g database hosted on a Dell R900 server with 16 Intel 64-bit processors connected to a CLARiiON CX4-960 storage array. The figures below show EMC’s hardware configurations. In the configuration shown below, six back-end buses out of the total eight back-end buses on a CX4-960 are used. You should configure your back-end buses depending on your I/O requirement and by following EMC best practices for bus and disk layout. Figure 4 shows the hardware system setup with front-end connections on the left side and CX4-960 back-end connections on the right side.

For the SAP system, we have created two storage pools and four RAID 5 pool LUNs carved out of the first storage pool, and two RAID 5 LUNs out of the second storage pool, on the CLARiiON CX4-960 to use it for the SAP FAST Cache configuration scenarios. Four LUNs from the first storage pool were used as DATA volumes (DATA1, DATA2, DATA3, DATA4), and two RAID 5 LUNs from the second storage pool were used as LOG volumes (LOG1, LOG2) for SAP’s Oracle database. DATA LUNs and LOG LUNs
were created on different storage pools for better performance and recoverability. FAST Cache is only enabled on the DATA LUNs and disabled on LOG LUNs for our study. We have used 10 x 200 GB Flash drives to create the read/write FAST Cache. For our study we have created several storage pools with different numbers of drives. Details are covered in the FAST Cache configuration scenarios section.

**SAP workload**

The SAP workload used in this study consists of 20 business processes from the SAP FI, SD, MM, and PP modules, which contained several batch jobs running in parallel accessing the 1.3 TB database. The OLTP style transactions in this workload read the customer data from the disk and process the customer data, and then update the data. The workload characteristics have been kept constant for all the configuration scenarios described next so that one can make a relative comparison of application metrics. To understand the impact of FAST Cache on the SAP ECC system in these tests, we focused on I/O throughput and response times of the batch jobs by running the workload on several configurations.

EMC also used the following configuration scenarios to compare application-level metrics to demonstrate the impact of FAST Cache on the workload in terms of performance and TCO. The goal of this test is to show how FAST Cache can significantly reduce the number of IOPS received from rotating spindles by relocating the hot data to faster Flash drives to improve performance.

**FAST Cache configuration scenarios**

To characterize FAST Cache with SAP transactions, EMC has used the following configuration scenarios with the SAP workload described above and demonstrated the benefits of FAST Cache technology in the typical SAP deployments. In this workload, the OLTP style transactions simulate the reading of customer data from the disk, followed by processing and updating of the data.

<table>
<thead>
<tr>
<th>Baseline Scenario</th>
<th>Storage pools with 90 x 600 GB Fibre Channel drives configured as one tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>90 x 600 GB Fibre Channel drives with FAST Cache created on 10 x 200 GB Flash drives in a read/write mode</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>45 x 600 GB Fibre Channel drives with FAST Cache created on 10 x 200 GB Flash drives in a read/write mode</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>25 x 600 GB Fibre Channel drives with FAST Cache created on 10 x 200 GB Flash drives in a read/write mode</td>
</tr>
<tr>
<td>Scenario 4</td>
<td>45 x 2 TB SATA drives with FAST Cache created on 10 x 200 GB Flash drives in a read/write mode</td>
</tr>
</tbody>
</table>
Baseline Scenario

Figure 5 shows the SAP workload running on the baseline storage pool configuration established on an all-FC rotating drive configuration. There were 90 x 600 GB disks used in this setup with SAP data files deployed on 85 drives and SAP online redo logs on five drives. It took approximately 123,593 seconds (34.3 hours) for all 20 jobs to complete and the longest job took 6,992 seconds (116 minutes).

Scenario 1

In this scenario the SAP workload is configured to run on exactly the same baseline storage pool configuration just described except that FAST Cache is created on 10 x 200 GB Flash drives and is enabled on all the data file LUNs. FAST Cache is not enabled on the online redo log LUNs as it is not going to be very beneficial compared to enabling it on data file LUNs. In this configuration, the frequently used data is cached by FAST Cache, providing improved latencies to the most accessed data and thereby improving overall application performance. This configuration obtained three
times better performance when compared to the baseline configuration performance. This shows a significant return after adding FAST Cache. By looking at transaction completion times, it took approximately 39,891 seconds (11.1 hours) total for the 20 jobs to complete where the longest job took 2,160 seconds (36 minutes).

Figure 6. SAP workload running on a Baseline Scenario storage pool with 10 FC drives and FAST Cache

Scenario 2

The 45 x 600 GB rotating Fibre Channel configuration with FAST Cache yields almost the same transactions timings as that of the 90 x 600 GB FC drive configuration with FAST Cache. This is a huge reduction in cost that already justifies the added cost of FAST Cache while at the same time achieving three times better performance compared to the baseline configuration. In this scenario, it took approximately 38,250 seconds (10.6 hours) together for the 20 jobs to complete where the longest job took 2,106 seconds (35 minutes).
Using EMC FAST Cache with SAP on EMC Unified Storage

Figure 7. SAP workload running on a storage pool with 45 FC drives and FAST Cache

Scenario 3

The 25 x 600 GB rotating FC configuration with FAST Cache yields almost the same transactions timings as that of the 90 x 600 GB FC drive configuration with FAST Cache. This is a huge reduction in cost that already justifies the added cost of FAST Cache while at the same time achieving three times better performance compared to the baseline configuration. In this scenario, it took approximately 39,269 seconds (10.9 hours) together for the 20 jobs to complete where the longest job took 2,128 seconds (35 minutes).
Scenario 4

The SAP database layout used in this scenario is identical to that of Scenario 1, except that the SAP database is now laid out on 45 x 2 TB SATA drives instead of 90 x 600 GB rotating FC drives. FAST Cache is also created on 10 x 200 GB Flash drives and is enabled on all the data file LUNs and not on the online redo log LUNs for the reasons stated earlier. The performance in this scenario was very similar to Scenario 1 with nearly three times improvement even though this is a SATA configuration. This is exceptional improvement in the TCO of the system given the lower price of SATA drives and almost three times the usable space. Even when most of our tests indicate that the SATA drives are almost as reliable as FC drives, the reliability of SATA drives seems to be one of the major concerns of production DBAs and storage administrators. The alternate RAID options like RAID 6 or RAID 1/0 can be considered if reliability is a concern. The added parity cost of RAID 6 may not be a major issue as only a fraction of I/Os is targeted at the rotating medium once the FAST Cache starts absorbing the majority of the I/O. The next figure shows the SAP workload running using this configuration. In this scenario, even with SATA drives, it took approximately
39,550 seconds (11 hours) together for the 20 jobs to complete where the longest job took 2,187 seconds (36 minutes).

Figure 9. SAP workload running on a storage pool with 45 SATA drives and FAST Cache

Additional scenarios

In addition to these scenarios we have also experimented with other scenarios by using the SAP database layout identical to Scenario 1, but replacing the number of drives in Scenario 1 with only 15 x 600 GB. We are not going to cover this scenario in detail. In these scenarios we also have observed results similar to Scenario 1 because of the use of FAST Cache.
## Analysis of results

### Table 1. Comparison of SAP workload durations

<table>
<thead>
<tr>
<th>FAST Cache Configuration scenario</th>
<th>Total duration (sec) for the workload</th>
<th>Duration (sec) for the longest job in the workload</th>
<th>Performance improvement factor</th>
<th>Storage capacity (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Scenario (90 FC Drives)</td>
<td>123593</td>
<td>6992</td>
<td>NA</td>
<td>54000</td>
</tr>
<tr>
<td>Scenario 1 (90 FC Drives + FAST Cache)</td>
<td>39891</td>
<td>2160</td>
<td>3x</td>
<td>54000</td>
</tr>
<tr>
<td>Scenario 2 (45 FC Drives + FAST Cache)</td>
<td>38250</td>
<td>2106</td>
<td>3x</td>
<td>27000</td>
</tr>
<tr>
<td>Scenario 3 (25 FC Drives + FAST Cache)</td>
<td>39269</td>
<td>2128</td>
<td>3x</td>
<td>15000</td>
</tr>
<tr>
<td>Scenario 4 (45 SATA II Drives + FAST Cache)</td>
<td>39550</td>
<td>2187</td>
<td>3x</td>
<td>90000</td>
</tr>
</tbody>
</table>

After analyzing the results, in the case of the baseline scenario configured with the storage pool that contains 90 FC drives, it took longer to complete all the transactions in the SAP workload. After enabling FAST Cache, the phase of the longest running job in the workload changed from 6,992 seconds to 2,160 seconds when comparing the Baseline Scenario with Scenario 1. This results in an improvement of approximately three times faster than the baseline. The improvement we observed for the total duration of the workload when using the FAST Cache feature (123,593 seconds vs. 39,891 seconds) also resulted in three times faster performance. This result is also in line with the individual workload job duration improvements. In our study, we have also observed considerable improvements with Scenario 2, Scenario 3, and even in Scenario 4, which is configured with all SATA drives. In terms of TCO, by considering performance, storage capacity, and storage drive cost, Scenario 3 provides an optimal configuration by compensating the reduced storage capacity with an additional SATA tier along with the FC tier.

Figure 10 shows the performance gain by enabling FAST Cache on a storage pool with 90 x 600 GB Fibre Channel drives configured as one tier. This is the scenario where FAST Cache is added to the existing SAP system storage array without disturbing the current storage configuration.
Figure 10. FAST performance (Baseline vs. Baseline with FAST Cache)

Figure 11 shows the TCO advantage realized by enabling FAST Cache while reducing the storage pool size. Here the reduced storage capacity can be compensated by adding an additional SATA tier along with the FC tier. In our study, storage pools with SATA drives performed comparable to the storage pool with the FC drives when FAST Cache is used. In the case of existing SAP systems the storage configuration needed to be changed to benefit from the reduction in cost and improved performance.

Figure 11. FAST TCO (Baseline vs. Scenario 3 with FAST Cache)

Conclusion

FAST Cache technology significantly increases performance and reduces the TCO of SAP enterprise applications by reducing the investment for the Flash tier and improving the capacity utilization of the rotating drives. In an environment where storage resources are shared among various applications, enabling the FAST Cache
on a particular OLTP application will result in improved I/O performance. The application-agnostic nature of FAST Cache technology makes it applicable to any application with a low I/O latency requirement. Even though FAST Cache technology can be used with any application with any type of I/O pattern, it is especially very well suited for applications with small random I/O and relatively small working sets compared to the total database size. Different models of CLARiiON arrays support various sizes of FAST Cache, therefore, the right-sizing of FAST Cache is very important to maximize the benefit. The following best practices should be followed to realize the full advantage of FAST Cache:

- Disable FAST Cache on LUNs that do not require it (for example, log LUNs).
- Size FAST Cache appropriately depending on the application active dataset.
- Disable FAST Cache on LUNs where SAP database online redo logs reside. Enabling FAST Cache on database online redo logs may or may not help depending on workload characteristics. The relative gains of enabling FAST Cache on online redo logs will be small compared to enabling it on LUNs with a database’s data files.
- Never enable FAST Cache on archive logs as these files are never overwritten and rarely read back unless the database needs recovery.

References

- [EMC CLARiiON and Celerra Unified FAST Cache - A Detailed Review](http://whitepaper.com) white paper
- [Leveraging EMC CLARiiON CX4 with Enterprise Flash Drives for SAP Deployments](http://whitepaper.com) white paper
- [Using EMC FAST with SAP on EMC Unified Storage](http://whitepaper.com) white paper
- Adaptive Hardware Infrastructures for SAP
- SAP Performance Optimization Guide

The following websites can also be used for more information:

- SAP Community Network: [http://sdn.sap.com](http://sdn.sap.com)