



Manage SSD cache

SANtricity software

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Manage SSD cache

How SSD Cache works in SANtricity software

The SSD Cache feature is a controller-based solution that caches the most frequently accessed data ("hot" data) onto lower latency Solid State Drives (SSDs) to dynamically accelerate system performance. SSD Cache is used exclusively for host reads.

SSD Cache versus primary cache

SSD Cache is a secondary cache for use with the primary cache in the controller's dynamic random-access memory (DRAM).

SSD Cache operates differently than primary cache:

- For primary cache, each I/O operation must stage data through the cache to perform the operation.

In primary cache, the data is stored in DRAM after a host read.

- SSD Cache is used only if it is beneficial to place the data in cache to improve overall system performance.

In SSD Cache, the data is copied from volumes and stored on two internal RAID volumes (one per controller) that are automatically created when you create an SSD Cache.

The internal RAID volumes are used for internal cache processing purposes. These volumes are not accessible or displayed in the user interface. However, these two volumes do count against the total number of volumes allowed in the storage array.

How SSD Cache is used

Intelligent caching places data in a lower-latency drive so responses to future requests for that data can occur much faster. If a program requests data that is in the cache (called a "cache hit"), then the lower-latency drive can service that transaction. Otherwise, a "cache miss" occurs and the data must be accessed from the original, slower drive. As more cache hits occur, overall performance improves.

When a host program accesses the storage array's drives, the data is stored in the SSD Cache. When the same data is accessed by the host program again, it is read from the SSD Cache instead of the hard drives. The commonly accessed data is stored in the SSD Cache. The hard drives are only accessed when the data cannot be read from the SSD Cache.

SSD Cache is used only when it is beneficial to place the data in cache to improve overall system performance.

When the CPU needs to process read data, it follows the steps below:

1. Check DRAM cache.
2. If not found in DRAM cache, then check SSD Cache.
3. If not found in SSD Cache, then get from hard drive. If data is deemed worthwhile to cache, then copy to SSD Cache.

Improved performance

Copying the most accessed data (hot spot) to SSD Cache allows for more efficient hard disk operation, reduced latency, and accelerated read and write speeds. Using high performance SSDs to cache data from HDD volumes improves I/O performance and response times.

Simple volume I/O mechanisms are used to move data to and from the SSD Cache. After data is cached and stored on the SSDs, subsequent reads of that data are performed on the SSD Cache, thereby eliminating the need to access the HDD volume.

SSD Cache and the Drive Security feature

To use SSD Cache on a volume that is also using Drive Security (is secure-enabled), the Drive Security capabilities of the volume and the SSD Cache must match. If they do not match, the volume will not be secure-enabled.

Implement SSD Cache

To implement SSD Cache, do the following:

1. Create the SSD Cache.
2. Associate the SSD Cache with the volumes for which you want to implement SSD read caching.



Any volume assigned to use a controller's SSD Cache is not eligible for an automatic load balance transfer.

Learn about SSD cache restrictions in SANtricity software

Learn about the restrictions when using SSD Cache on your storage array.

Restrictions

- Any volume assigned to use a controller's SSD Cache is not eligible for an automatic load balance transfer.
- Currently, only one SSD Cache is supported per storage array.
- The maximum usable SSD Cache capacity on a storage array is 10 TB.
- SSD Cache is not supported on snapshot images.
- If you import or export volumes that are SSD Cache enabled or disabled, the cached data is not imported or exported.
- You cannot remove the last drive in an SSD Cache without first deleting the SSD Cache.

Restrictions with Drive Security

- You can enable security on SSD Cache only when you create the SSD Cache. You cannot enable security later as you can on a volume.
- If you mix drives that are secure-capable with drives that are not secure-capable in SSD Cache, you cannot enable Drive Security for these drives.
- Secure-enabled volumes must have an SSD Cache that is secure enabled.

Create an SSD Cache in SANtricity System Manager

To dynamically accelerate system performance, you can use the SSD Cache feature to cache the most frequently accessed data ("hot" data) onto lower latency Solid State Drives (SSDs). SSD Cache is used exclusively for host reads.

Before you begin

Your storage array must contain some SSD drives.

About this task

When you create a new SSD Cache, you can use a single drive or multiple drives. Because the read cache is in the storage array, caching is shared across all applications using the storage array. You select the volumes that you want to cache, and then caching is automatic and dynamic.

Follow these guidelines when you create a new SSD Cache.

- You can enable security on the SSD Cache only when you are creating it, not later.
- Only one SSD Cache is supported per storage array.
- If only one volume has SSD cache enabled, then the entire SSD cache will be assigned to the controller owning that volume.
- The maximum usable SSD Cache capacity on a storage array is dependent on the controller's primary cache capacity.
- SSD Cache is not supported on snapshot images.
- If you import or export volumes that are SSD Cache enabled or disabled, the cached data is not imported or exported.
- Any volume assigned to use a controller's SSD Cache is not eligible for an automatic load balance transfer.
- If the associated volumes are secure-enabled, create a secure-enabled SSD Cache.


Steps

1. Select **Storage > Pools & Volume Groups**.
2. Click **Create > SSD Cache**.

The Create SSD Cache dialog box appears.

3. Type a name for the SSD Cache.
4. Select the SSD Cache candidate that you want to use based on the following characteristics.

Characteristic	Use
Capacity	<p>Shows the available capacity in GiB. Select the capacity for your application's storage needs.</p> <p>The maximum capacity for SSD Cache depends on the controller's primary cache capacity. If you allocate more than the maximum amount to SSD Cache, then any extra capacity is unusable.</p> <p>SSD Cache capacity counts towards your overall allocated capacity.</p>

Characteristic	Use
Total drives	Shows the number of drives available for this SSD cache. Select the SSD candidate with the number of drives that you want.
Secure-capable	<p>Indicates whether the SSD Cache candidate is comprised entirely of secure-capable drives, which can be either Full Disk Encryption (FDE) drives or Federal Information Processing Standard (FIPS) drives.</p> <p>If you want to create a secure-enabled SSD Cache, look for Yes - FDE or Yes - FIPS in the Secure-capable column.</p>
Enable security?	<p>Provides the option for enabling the Drive Security feature with secure-capable drives. If you want to create a secure-enabled SSD Cache, select the Enable Security check box.</p> <div>  <p>Once enabled, security cannot be disabled. You can enable security on the SSD Cache only when you are creating it, not later.</p> </div>
DA capable	<p>Indicates if Data Assurance (DA) is available for this SSD Cache candidate. Data Assurance (DA) checks for and corrects errors that might occur as data is transferred through the controllers down to the drives.</p> <p>If you want to use DA, select an SSD Cache candidate that is DA capable. This option is available only when the DA feature has been enabled.</p> <p>SSD Cache can contain both DA-capable and non-DA-capable drives, but all drives must be DA-capable for you to use DA.</p>

- Associate the SSD Cache with the volumes for which you want to implement SSD read caching. To enable SSD Cache on compatible volumes immediately, select the **Enable SSD Cache on existing compatible volumes that are mapped to hosts** check box.

Volumes are compatible if they share the same Drive Security and DA capabilities.

- Click **Create**.

Change the SSD Cache settings in SANtricity System Manager

You can edit the name of the SSD Cache and view its status, maximum and current capacity, Drive Security and Data Assurance status, and its associated volumes and drives.

Steps

- Select **Storage > Pools & Volume Groups**.
- Select the SSD Cache that you want to edit, and then click **View/Edit Settings**.

The SSD Cache Settings dialog box appears.

3. Review or edit the SSD Cache settings as appropriate.

Field details

Setting	Description
Name	Displays the name of the SSD Cache, which you can change. A name for the SSD Cache is required.
Characteristics	<p>Shows the status for the SSD Cache. Possible statuses include:</p> <ul style="list-style-type: none">• Optimal• Unknown• Degraded• Failed (A failed state results in a critical MEL event.)• Suspended
Capacities	<p>Shows the current capacity and maximum capacity allowed for the SSD Cache.</p> <p>The maximum capacity allowed for the SSD Cache depends on the controller's primary cache size:</p> <ul style="list-style-type: none">• Up to 1 GiB• 1 GiB to 2 GiB• 2 GiB to 4 GiB• More than 4 GiB
Security and DA	<p>Shows the Drive Security and Data Assurance status for the SSD Cache.</p> <ul style="list-style-type: none">• Secure-capable — Indicates whether the SSD Cache is comprised entirely of secure-capable drives. A secure-capable drive is a self-encrypting drive that can protect its data from unauthorized access.• Secure-enabled — Indicates whether security is enabled on the SSD Cache.• DA capable — Indicates whether the SSD Cache is comprised entirely of DA-capable drives. A DA-capable drive can check for and correct errors that might occur as data is communicated between the host and storage array.
Associated objects	Shows the volumes and drives associated with the SSD Cache.

4. Click **Save**.

View SSD Cache statistics in SANtricity System Manager

You can view statistics for the SSD Cache, such as reads, writes, cache hits, cache allocation percentage, and cache utilization percentage.

The nominal statistics, which are a subset of the detailed statistics, are shown on the View SSD Cache Statistics dialog box. You can view detailed statistics for the SSD Cache only when you export all SSD statistics to a `.csv` file.

As you review and interpret the statistics, keep in mind that some interpretations are derived by looking at a combination of statistics.

Steps

1. Select **Storage › Pools & Volume Groups**.
2. Select the SSD Cache for which you want to view statistics, and then click **More › View SSD Cache statistics**.

The View SSD Cache Statistics dialog box appears and displays the nominal statistics for the selected SSD cache.

Field details

Settings	Description
Reads	Shows the total number of host reads from the SSD Cache-enabled volumes. The greater the ratio of Reads to Writes, the better is the operation of the cache.
Writes	The total number of host writes to the SSD Cache-enabled volumes. The greater the ratio of Reads to Writes, the better is the operation of the cache.
Cache hits	Shows the number of cache hits.
Cache hits %	Shows the percentage of cache hits. This number is derived from Cache Hits / (reads + writes). The cache hit percentage should be greater than 50 percent for effective SSD Cache operation.
Cache allocation %	Shows the percentage of SSD Cache storage that is allocated, expressed as a percentage of the SSD Cache storage that is available to this controller and is derived from allocated bytes / available bytes.
Cache utilization %	Shows the percentage of SSD Cache storage that contains data from enabled volumes, expressed as a percentage of SSD Cache storage that is allocated. This amount represents the utilization or density of the SSD Cache. Derived from allocated bytes / available bytes.
Export All	Exports all SSD Cache statistics to a CSV format. The exported file contains all available statistics for the SSD Cache (both nominal and detailed).

3. Click **Cancel** to close the dialog box.

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