Overview of ShadowImage

Hitachi ShadowImage® (SI) uses local mirroring technology to create and maintain full copies of data volumes within a storage system.

Using SI volume copies (for example: backups, secondary host applications, data mining, testing) allows you to continue working without stopping host application input/output (I/O) in the production volume.

How ShadowImage works

A pair is created when you:

• Select a volume that you want to duplicate. This becomes the primary volume (P-VOL).
• Identify another volume to contain the copy. This becomes the secondary volume (S-VOL).
• Associate the P-VOL and S-VOLs.
• Perform the initial copy.

During the initial copy, the P-VOL remains available for read/write. After the copy is completed, subsequent write operations to the P-VOL are regularly duplicated to the S-VOL.

The P-VOL and S-VOLs remain paired until they are split. The P-VOL for a split pair continues to be updated but data in the S-VOL remains as it was at the time of the split. The S-VOL contains a mirror image of the original volume at that point in time.

• S-VOL data is consistent and usable. It is available for read/write access by secondary host applications.
• Changes to the P-VOLs and S-VOLs are managed by differential bitmaps.
• You can pair the volumes again by resynchronizing the update data from P-VOL to S-VOL, or from S-VOL to P-VOL.

Note

In Device Manager - Storage Navigator (HDvM - SN), the source volume is called P-VOL and the destination volume is called S-VOL.

Hardware and software components

A typical configuration consists of a storage system, a host connected to the storage system, the SI software, a primary or source volume (P-VOL), and secondary or target volumes (S-VOLs), and interface tools for operating SI.

The following image shows a typical configuration.
**Consistency groups**

Use a consistency group (CTG) to perform tasks on the SI pairs in the group at the same time, including CTG pair-split tasks. Using a CTG to perform tasks ensures the consistency of the pair status for all pairs in the group.

**Volume pairs**

A volume pair consists of a P-VOL and one to three layer-1 (L1) pair S-VOLs.

Because S-VOLs are updated asynchronously, the P-VOL and S-VOLs might not be identical except immediately after a split. If a pair is split, any further updates to the P-VOL will not be reflected in the S-VOL.

Splitting or deleting a pair allows the host access to the S-VOL.

**Cascaded pairs**
Cascaded pairs are volume pairs created in the first and second layer. A pair made up of an L1 S-VOL and a layer-2 (L2) S-VOL is an L2 pair. You can pair each SI L1 S-VOL with two L2 S-VOLs. You can pair nine L1 and L2 S-VOLs with a P-VOL.

The following image shows the structure of cascaded pairs.

In cascaded pairs, the P-VOL for an L1 pair is a root volume and the S-VOL is a node volume. The P-VOL for an L2 pair is the S-VOL of an L1 pair, a node volume, and the S-VOL is a leaf volume.

**Initial and update copy operations**

Creating a pair causes the storage system to start the initial copy. During the initial copy, the P-VOL remains available for read and write operations from the host. After the initial copy, the storage system periodically copies the differential data in the P-VOL to the S-VOL. Subsequent write operations to the P-VOL are regularly duplicated to the S-VOL. The data in the P-VOL is copied to the S-VOL.

**Initial copy workflow**

Initial copy is performed when you create a copy pair. Data on the P-VOL is copied to the S-VOL for the initial copy using the following workflow.

The storage system goes through the following workflow to create an initial copy:

1. The S-VOLs are not paired. You create the copy pair.
The storage system accepts read/write for unpaired volumes.

2. The initial copy is in progress (COPY(PD)/COPY status). The storage system copies the P-VOL data to the S-VOL.

3. The initial copy is complete and the volumes are paired (PAIR status).
   Note: Data consistency is not ensured for SI pairs in PAIR status.

A P-VOL continues receiving updates from the host during the initial copy.

**Update copy workflow**

Update copy is performed to asynchronously copy new data (differential data) from the P-VOL of a copy volume to the S-VOL.

The storage system goes through the following process to create an update copy:

1. The storage system marks I/O to the P-VOL in PAIR status as differential data and stores the location of the data in bitmaps for transfer to the S-VOL.

2. After there are write I/O operations to a P-VOL, the storage system starts the update copy operation.
   Note: The timing of the update copy operation is based on the amount of differential data that accumulates and the elapsed time since the previous update.

The following image shows the update copy operation.
Updated data is copied asynchronously. Therefore, even when the initial copy completes and the pair status changes to PAIR, data in the P-VOL and in the S-VOL might not be the same. If you want data in the P-VOL and in the S-VOL to match at a certain date and time, you must split the pair.

Note: Data in the P-VOL and in the S-VOL might not be the same if the host did not write data to the P-VOL during copy operation. To ensure matching data in the P-VOL and the S-VOL, you must split the pair to change its status to PSUS.