Overview of Thin Image

With Hitachi Thin Image (HTI), you can perform cost-effective replication by storing the differential data between primary volumes (P-VOLs) and secondary volumes (S-VOLs) of virtual volumes (V-VOLs). You can also copy data of an entire volume, instead of copying just the differential data, to a volume. By copying the entire volume, you can expect a higher performance than by just storing the differential data.

About Thin Image

Hitachi Thin Image stores snapshots in a Hitachi Virtual Storage Platform family (VSP family) storage system. If the data of the storage system fails, you can restore it using the stored snapshot of the data. Pairs created by using Thin Image are called Thin Image pairs in this document.

To store snapshot data, you create a pair with a logical volume functioning as the P-VOL, and a virtual volume as the S-VOL. A pair created to store snapshot data is referred to as a snapshot pair. A snapshot pair displays showing the snapshot attribute.

When you create a Thin Image pair, the status changes to "PAIR" and snapshot data is stored. You can use Thin Image to store a maximum of 1,024 snapshots of data (including the number of clones when you clone a volume).

Updating the P-VOL first copies the differential data as snapshot data in pool volumes (pool-VOL), and then updates the data. Snapshot data is a copy of differential data in Thin Image P-VOLs. If your storage system experiences a data storage failure, you can restore the data using the snapshot data in the pool.

Splitting a Thin Image pair saves a snapshot and stops the copying of replaced data in the pool.

The following figure provides a basic illustration of storing snapshot data.
You can use snapshot data in open-system volumes.

### Acronyms and abbreviations for VSP family storage system software applications used in this guide

This user guide uses the following acronyms and abbreviations for software names.

- FCv2: Compatible FlashCopy® V2
- FCSE: Hitachi Compatible FlashCopy®
- GAD: global-active device
- SI: ShadowImage
- SIz: ShadowImage for Mainframe
- TC: TrueCopy
- TCz: TrueCopy for Mainframe
- HTI: Hitachi Thin Image
- UR: Universal Replicator
- URz: Universal Replicator for Mainframe

### Workflow for storing Thin Image snapshot data

Snapshot data is data in the pool, which is replaced data. Use this workflow to store snapshot data in the pool.

1. Create a Thin Image pair. You can create a pair with the snapshot attribute (snapshot pairs). The pair is in "PAIR" status.
2. The host updates the primary volume.
3. Split the snapshot pairs. The snapshot data of the primary volume is stored (Snapshot data A in the figure below).
4. The host updates the primary volume again.
5. Split the snapshot pairs. The updated data in the primary volume is stored as snapshot data (Snapshot data B in the following figure). In the event of data corruption, you can recover using this snapshot data.

The following figure illustrates how data in the pool is replaced.

Note Because Snapshot data A and Snapshot data B are handled as a Thin Image S-VOL of a snapshot pair, the host can reference the P-VOL, Snapshot data A, and Snapshot data B.

**Using snapshot pairs (not cascaded)**

The following figure shows how snapshot pairs are used when they are not cascaded.

Data in the P-VOL is backed up one time every day. The P-VOL can be restored using the S-VOL if a logical failure occurs during data update or if there is a virus in the P-VOL.
Using cascaded pairs

Distributing data in the P-VOL to multiple users

Create the same number of leaf volumes as the number of users to whom you want to distribute data. This allows you to distribute data in the P-VOL without increasing loads to the P-VOL.

Distributing updated data in the P-VOL to specified users

Legend:
- P-VOL: Primary volume
- S-VOL: Secondary volume
- #: Pair with snapshot attribute
- : Data

https://knowledge.hitachivantara.com/Documents/Management_Software/SVOS/8.3/Local_Replication/Thin_Image/01_Overvi...
When you update the P-VOL and want to give it only to the specified users (S-VOLs 5 and 6 in the figure), do the following:

1. Create cascaded pairs, and distribute data in the P-VOL. Assign users to whom you want to distribute the updated data, and users to whom you do not want to distribute the updated data to separate node volumes.
2. Delete the pairs in the node volume where you assigned users you do not want to distribute the updated data to (S-VOL 1 in the figure).
3. Update the P-VOL.

Creating a new distributor with cloned pairs
1. Create cascaded pairs and distribute data in the P-VOL. Assign the clone attribute to the volume to be a new distributor (S-VOL 3 in the figure).

2. Clone pairs.

By cloning pairs, S-VOL 3 and S-VOL 1 become unpaired volumes (DP-VOLs) in the same status, and S-VOL 3 can be a new distributor. As a result, the overhead of the Thin Image pairs can be reduced.

**Snapshot Clones**

When distributing data in a storage system, you can use clones to improve efficiency.

The following figure illustrates cloning.
When cloning pairs, use a logical volume as the P-VOL and a DP-VOL as the S-VOL.

If you split pairs that have the clone attribute, the data of the entire P-VOL is copied to the S-VOL asynchronously to create a clone of the primary volume. When the copy completes, pairs are deleted and the S-VOL is unpaired (becomes a DP-VOL). This volume can be used as a volume in the same status as the P-VOL. This operation is referred to as cloning pairs.

A maximum of 1,024 clones (including the number of snapshots if you store them) can be created by using Thin Image.

Cloning pairs includes operations after the P-VOL is copied to the S-VOL, until volumes are unpaired. Volumes created by cloning are not included.

<table>
<thead>
<tr>
<th>Data recovery and backup differences between Thin Image and ShadowImage</th>
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<tr>
<td><strong>Item</strong></td>
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<tr>
<td>P-VOL physical failures such as hard disks.</td>
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<tr>
<td>P-VOL logical failures such as data update errors or viruses.</td>
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<tr>
<td>Capacity required for backup.</td>
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<tr>
<td>Impact on P-VOL performance when cloning pairs</td>
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</tbody>
</table>
### Item | Thin Image (HTI) | ShadowImage (SI)
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accessing backed up data. | because data in the P-VOL is shared.\(^2\) | because the P-VOL and the S-VOL can be disconnected.

| S-VOL or pool physical failures | If a physical failure occurs in a pool\(^3\), data in all S-VOLs that use the pool cannot be guaranteed. | If a physical failure occurs in an S-VOL, data in the S-VOL cannot be guaranteed.

### Notes:

1. For snapshot pairs. When a cloned pair is created, all data in the P-VOL is retained and more capacity is required for backup.
2. For snapshot pairs. When a cloned pair is created, the P-VOL and the S-VOL can be separated and the P-VOL performance is not affected.
3. When a pool is full (the depletion threshold is exceeded in a pool for which the capacity for TI pairs is limited), data in all S-VOLs using the pool cannot be guaranteed.

### Recommended usage

To maintain backed up data for long periods, save it on magnetic tapes or other media. For temporary backups use HTI or SI. When backing up data to magnetic tapes use SI. To reduce the capacity necessary for backups use HTI, but note that this affects P-VOL performance.

Use SI to minimize the impact from P-VOL physical failures. If you need four or more generations of backups, use both SI and HTI as shown in the following figure.

Use HTI to minimize P-VOL logical failures.