Accelerated compression

Accelerated compression-enabled parity groups

Data on LDEVs carved from parity groups comprised of FMD drives is compressed before it is stored onto the drives. The default setting of accelerated compression is Disabled. You must set this feature to Enable to take advantage of the data compression services on the accelerated compression enabled drive.

Note encryption is enabled on an accelerated compression enabled parity group, accelerated compression cannot be enabled on that parity group. You can use the deduplication and compression functions on encrypted accelerated compression enabled accelerated compression parity group.

When you enable accelerated compression on a parity group comprised of accelerated compression enabled drives:

- The capacity of the parity group expands the usable physical capacity of the parity group. You can potentially carve out LDEVs from this expanded capacity and use them as pool volumes to create or expand a pool. When you do this, you can utilize the increased available capacity because the data on the accelerated compression enabled drives has been compressed.

- LDEVs carved from the accelerated compression-enabled parity groups can only be used as pool volumes to create or expand a pool. These LDEVs cannot be assigned directly to a host and must be assigned to a single pool as pool volumes. LDEVs from a single parity group cannot be shared among multiple pools.

For the accelerated compression-enabled parity group, the total of the physical capacity and expanded area is displayed as the parity group capacity.

About pool volumes from accelerated compression-enabled parity groups

Volumes carved from accelerated compression-enabled parity groups can only be used as pool volumes to create or expand a pool. Pools that contain pool volumes from accelerated compression-enabled parity groups must be monitored to ensure adequate pool capacity. You can set thresholds for used pool capacity that trigger the output of SIMs when

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exceeded, enabling you to expand the pool or delete unwanted data before the pool becomes full. LDEVs that are created by Storage Navigator are allocated in the physical capacity area only. If you create LDEVs using Command Control Interface, it is recommended that you create LDEVs in the physical capacity area. You can confirm the location for LDEVs to be created in the View Physical Location window.

**Automatically adding pool volumes function**

When this function is used, if you operate a pool comprised of pool volumes assigned to accelerated compression-enabled parity groups, new pool volumes are automatically added when the free spaces in a pool run low. Additionally, related to the data usage rate of the data written by a host, pool volumes are automatically created and added to a pool. Therefore, you do not have to plan a configuration definition for pool volumes related to the compression rates. If the accelerated compression-enabled parity group is used in the pool, the automatically adding pool volumes function is automatically enabled. If this function is changed to disable per pool, use the Command Control Interface. For commands, see the [Command Control Interface Command Reference](https://knowledge.hitachivantara.com/Documents/Management_Software/SVOS/8.1/Volume_Management/Data_Reduction/3_Accelerated_compression).

**Storing data written to DP-VOLs**

Data written by hosts to DP-VOLs is stored in pool volumes on a page basis. If pool volumes are created from the parity group used by accelerated compression enabled drives, data is compressed and stored to drives. The compression ratio of data varies for each data update or data deletion operation. The capacity which is displayed as the used capacity is the user data capacity which is compressed by FMD. Therefore, for a pool containing pool volumes with accelerated compression enabled, the smaller capacity of the following capacities is displayed as the pool capacity of which data can be stored: The total capacity of the pool volumes or The capacity of the parity group to which the pool volumes are defined. If pool volumes carved from the accelerated compression-enabled parity group and pool volumes carved from other parity groups are intermixed, the total capacity of the pool capacity is calculated by the following formula:

\[
Total \ writable \ capacity \ of \ the \ pool = The \ capacity \ which \ can \ store \ data \ in \ the \ accelerated \ pool + Total \ capacity \ of \ pool \ volumes \ carved \ from \ other \ parity \ groups.
\]

The purchased license of Dynamic Provisioning is consumed with respect to the defined pool capacity.

**Checking whether accelerated compression can be enabled**

Before enabling accelerated compression on a parity group, check whether it can be used with the parity group. Accelerated compression cannot be used on an FMD parity group if the parity group meets any of the following conditions:

- Encryption is enabled on the parity group.
- The LDEV carved from the parity group is not used as a pool volume.
- The LDEVs carved from the parity group are used as pool volumes in multiple pools.
- The full allocation function is enabled for all or any single DP-VOL associated with the pool containing the LDEV that is carved from the parity group.
If the DP-VOL that is associated with the pool containing the LDEV created from the FMD parity group is used as a journal volume of a Universal Replicator pair, we do not recommend using accelerated compression on this parity group.

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**Creating parity groups, LDEVs, and pools with accelerated compression**

After you have confirmed that the Saving % on used pool capacity is sufficient, you can create accelerated compression-enabled parity groups, LDEVs, and pools.

Use the following workflow to create accelerated compression-enabled parity groups, LDEVs, and pools:

**Caution**

When you create LDEVs in an accelerated compression-enabled FMD parity group, you must add all LDEVs you create to the same pool. If you do not add an LDEV to the pool, data recovery for a drive failure might fail. Make sure that you register all LDEVs to the pool.

During data recovery, LDEVs that were not added to the pool will be recovered to the FMD drive that was replaced when a failure occurred. In this case, the size of data to be recovered becomes greater than the original size, and the following might occur:

- The pool reduction ratio might become very low.
- The capacity of the FMD drive to which data is copied runs out, and data recovery might fail.
- The FMD drive capacity runs out, the write pending rate of cache remains high, and access to the storage system might be lost.

After data recovery, if you continue operation without formatting the following LDEVs, the FMD drive capacity remains consumed. As a result, the FMD capacity runs out, the write pending ratio of cache remains high, and access to the storage system might be lost:

- LDEVs used as normal volumes before the accelerated compression function is enabled
- LDEVs deleted from the pool because of the reduction of the pool capacity

To use LDEVs that are not registered to a pool, you must format them before the deletion. Quick format cannot be performed.
1. Check whether FMD parity groups are already used.

   If yes, go to step 2.

   If no, go to step 3.

2. Enable the accelerated compression function for an existing parity group. Use the Edit Parity Groups window to enable accelerated compression.

3. Use the new FMD capacity to create accelerated compression-enabled parity groups. Use the Create Parity Groups window to create parity groups.

4. Create LDEVs to be used as pool-VOLs. Use the Create LDEVs window to create LDEVs.

   Best practice is to create 2.99-TB LDEVs because this is the maximum capacity of a pool-VOL. Use the following formula to calculate the recommended value of the total LDEV capacity to be defined for one parity group:

   \[
   \text{Total LDEV capacity} = \frac{\text{FMD-capacity-of-the-parity-group}}{(100\% - (\text{Saving} \% - 10\%))} / 110\%
   \]

   The buffers in the formula are as follows:

   ◦ - 10%: Buffer representing the expected increase in capacity used because of degradation in the Saving %

   ◦ / 110%: Buffer representing the expected increase in capacity used to store management information of the storage system

   Note

   ◦ If the 14-TB FMD drive is used and the Saving % exceeds 75%, apply 75% for “Saving %” in the formula for total LDEV capacity.
The total capacity of LDEVs that can be created from a parity group of 14-TB FMD drives is equal to the total capacity of LDEVs that can be created from a parity group of 7-TB FMD drives (for example, up to 8x expansion for the 7-TB parity group but only 4x expansion for the 14-TB parity group). This is because the virtualized total capacity of LDEVs that can be created from a 14-TB FMD parity group exceeds the capacity of the Parity Group table.

For example, when the 3.2-TB FMD is used in a 3D+1P configuration and the estimated Saving % is 40%, the number of required LDEVs is calculated as follows:

1. Calculate the total capacity of the LDEVs to be created as follows:
   
   $$ \text{Total LDEV capacity} = \frac{9.6 \text{ TB}}{(100\% - (40\% - 10\%)) / 110\%} = 12.5 \text{ TB} $$

2. Calculate the number of LDEVs as follows. The value enclosed in ceiling( ) must be rounded up to the nearest whole number.
   
   $$ \text{ceiling}(12.5 \text{ TB} / 2.99 \text{ TB}) = 5 $$

   If the capacity of each LDEV is 2.99 TB, 5 LDEVs are required.

Note
If you use multiple parity groups, best practice is to configure the same basic usable capacity expansion rate for each parity group. Use the following formula to calculate the basic usable capacity expansion rate of the parity groups:

$$ \text{Basic usable capacity expansion rate of the parity groups} = \frac{\text{Total-capacity-of-the-LDEVs-created-from-the-parity-groups}}{\text{FMD-capacity-of-the-parity-groups}} $$

5. Create or expand the pool, and then add all of the created LDEVs to the same pool.
   
   Note
Add all of the LDEVs that were created from a single parity group to the same pool.

Note
For each accelerated compression-enabled parity group used to configure a pool, the pool capacity is decreased by 120 GB. The process of decreasing a pool capacity may take an extended period of time.

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**Enabling accelerated compression**

Use this procedure to enable accelerated compression on a parity group. If you change the accelerated compression from disable to enable for the parity group used by the pool, each of 120 GB on a basis of a accelerated compression-parity group are decreased in the pool. The process of decreasing a pool capacity may take an extended period of time.

**Before you begin**

- You must have the Storage Administrator role.
- The drive type of the target parity group must be one which supports the accelerated compression function.
- The RAID level and drive configuration of the target parity group must be accessible for use for pool volumes.
- The target parity group must be an internal parity group, block, or file.
- The status of LDEVs in the target parity group must be **Normal** or **Blocked**.
- All LDEVs in the parity group must already be added to the same pool.
- The capacity of the defined internal volumes must be 8 GB or more. (The capacity is equal to or greater than the minimum capacity of a pool volume.)
- If the defined internal volumes are used as pool volumes, those pool volumes belong to the same Dynamic Provisioning pool or Thin Image pool.
- The defined internal volumes must have no LUN path definitions.
- The defined internal volumes must not be used by Volume Migration.
- The defined internal volumes must not be reserved by the Data Retention Utility.
- The defined internal volumes must not have the Protect, Read Only, or S-VOL Disable attribute of Data Retention Utility.
- The encryption setting of the parity group must be disabled.
- There must not be any DP-VOL page reserved areas.

Procedure

1. In the Device Manager - Storage Navigator Explorer pane, select Storage Systems, and then expand the tree for the storage system.

2. Display the parity group for which you want to enable accelerated compression.
   - To display all parity groups in the storage system, click Parity Groups.
   - To display only internal parity groups, expand Parity Groups, and then click Internal.

3. Select the desired parity group, and then click More Actions Edit Parity Groups.

4. In Accelerated Compression, check Enable.
   
   **Caution**
   When you enable accelerated compression, confirm if the data reduction efficiency can be achieved. For details, see [GUID-E3D4AB72-202B-4969-AC7C-829F7EFDB4A](https://knowledge.hitachivantara.com/Documents/Management_Software/SVOS/8.1/Volume_Management/Data_Reduction/3_Accelerated_compression).

5. Click Finish.

6. In the Confirm window, confirm the settings. In Task Name, type a unique name for this task or accept the default, and then click Apply. If Go to tasks window for status is checked, the Tasks window opens.

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**Monitoring pool capacity**

The storage system monitors the pool's free capacity in accordance with threshold values defined when you create pools. If the pool capacity reaches the threshold values, the storage system issues service information messages (SIMs) and SNMP traps.

You can provision a larger virtual capacity beyond the pool capacity by using DP-VOLs of Dynamic Provisioning or Dynamic Tiering. However, when the pool's free capacity is depleted, you can lose access to DP-VOLs that require more pool capacity. For example, if the pool usage rate is 100% due to increased write operations, then I/O is not accepted and I/O will be stopped for a DP-VOL that failed to receive needed pool capacity. Therefore, you should carefully monitor the pool usage or pool free capacity as well as the level of provisioned virtual capacity.
Estimated FMD capacity when pool capacity is insufficient

If the pool capacity or physical pool capacity is insufficient, use the following workflow to estimate the capacity to be added.

Note: If the 14-TB FMD is used and the Saving % exceeds 75%, apply 75% for “Saving %” when calculating the required FMD capacity (third task in the workflow).

Disabling accelerated compression on a parity group

If you want to disable accelerated compression on a parity group, follow the workflow below:

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If you want to disable accelerated compression on a parity group, follow the workflow below:

1. Can pool volumes with Expanded Space Used = Yes be deleted from the pool (Shrink Pool)?
   - No
   - Yes
     - Expand the targeted pool by adding LDEVs with Expanded Space Used = No

2. Shrink the pool to remove pool volumes with Expanded Space Used = Yes

3. Format LDEVs with Expanded Space Used = Yes

4. Delete LDEVs with Expanded Space Used = Yes

End
Procedure

1. For the targeted pool, use the following formulas to determine whether the pool shrink can be performed:
   - Decision formula: Pool used capacity < Pool capacity after shrinking x Depletion threshold

   Use the following formula to calculate the Pool capacity after shrinking:
   - Pool capacity after shrinking = Pool capacity before shrinking - (Total capacity of pool-VOLs with Expanded Space Used is Yes)

   If the above decision formula is established, you can delete pool-VOLs with Expanded Space Used is Yes. Go to step 3.

   If the above decision formula is not established, you cannot delete pool-VOLs with Expanded Space Used is Yes. Go to step 2.

2. Expand the pool.

   By expanding the pool, add the capacity that is larger than the total of pool-VOLs with Expanded Space Used is Yes. For LDEVs to be added as pool-VOLs, use LDEVs with Expanded Space Used is No.

3. Shrink the pool so that all pool-VOLs in the pool are deleted.

4. Format LDEVs with Expanded Space Used is Yes.

5. Delete LDEVs with Expanded Space Used is Yes.

Disabling accelerated compression

Before you begin

- You must have the Storage Administrator (Provisioning) role.
- Set the parity group drive type to FMD.
- You should format the parity group.
- The target parity group must be an internal parity group.
- The RAID level and drive configuration of the target parity group must be accessible for use for pool volumes.
- The status of LDEVs in the target parity group must be Normal or Blocked.
- The Expanded Spaced Used column for the parity group must be No.

Procedure

1. Format the parity group.

   Caution

   Before you can disable accelerated compression, the parity group must be formatted.
2. In the Device Manager - Storage Navigator Explorer pane, select Storage Systems, and then expand the tree for the storage system.

3. Display the parity group for which you want to disable accelerated compression.
   - To display all parity groups in the storage system, click Parity Groups.
   - To display only internal parity groups, expand Parity Groups, and then click Internal.

4. Select the parity group, and click More Actions Edit Parity Groups.

5. In the Accelerated Compression setting, check Disable.

6. Click Finish.

7. In the Confirm window, confirm the settings. In Task Name, type a unique name for this task or accept the default, then click Apply. If Go to tasks window for status is checked, the Tasks window opens.