Recommendations for using IBM Real-time Compression with IBM Storwize V7000 for Lenovo

Guidance for the IBM Storwize V7000 for Lenovo offering

Provides information suitable for customers wishing to implement compression

Includes recommendations on configuring a balanced system

Presents implementation best practices

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Abstract

IBM Real-time Compression is an appliance providing on-line storage optimization through real-time data compression, delivering dramatic cost reduction without performance degradation. This guide is for IT professionals who have the tasks of sizing, planning, and implementing compression in IBM Storwize V7000 for Lenovo®.

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Introduction

Use the following process when you plan or implement a project with IBM Real-time Compression. Step-by-step implementation instructions are beyond the scope of this document; those details are covered in product documentation. The intention of this document is to provide high-level guidelines and considerations of an implementation that can lead to successful implementation of the solution itself.

Solution implementation overview and determining suitability for data compression

Before implementing this solution, use the Comprestimator utility. This host-based utility offers fast and accurate estimates of an expected compression rate for block devices. Use Comprestimator to estimate the compression ratio, and implement compression on volumes that have a compression ratio above 25%, and evaluate workload on volumes with low compression ratio (<25%).

The latest version of Comprestimator can be downloaded from the following location:

http://www-304.ibm.com/support/customercare/sas/f/comprestimator/home.html

As a general guideline, compress workloads that show more than 25% compression savings. Use the threshold for volume compressibility in Table 1 to help you decide whether to compress a volume.

Table 1   Table 1 recommendations are based on the data compression rate

Data compression rate	Recommendation
Higher than 25% savings	Use compression
Below 25% compression savings	Evaluate workload with compression

After verifying the expected compression rate using Comprestimator, the workload for a volume should be reviewed, to decide whether it is suitable for compression.

The following common workloads are typically suitable for use with compression:

► Database applications: Oracle, IBM DB2, Microsoft SQL, SAP
► Server/Desktop virtualization: VMware, KVM, Hyper-V
► Messaging: IBM Notes, Microsoft Exchange, (as long as attachments are not compressed file types)
► Others: Engineering, collaboration, seismic

Recommended IBM Storwize V7000 for Lenovo configuration

Version 7.3 supports IBM Storwize V7000 for Lenovo (6195-524). This model delivers outstanding performance for all kinds of workloads and is recommended when using Real-time Compression.

The following hardware configuration is highly recommended with Real-time Compression:

► IBM Storwize V7000 for Lenovo with 64GB memory
► 2x Compression Accelerator Cards (per canister)

The basic configuration of IBM Storwize V7000 for Lenovo with 32GB (per canister) and a single onboard Compression Accelerator Card is also supported with Real-time Compression, however it will not deliver the same performance levels as the recommended configuration with the extra RAM and Compression Acceleration Card.

System resource allocation on IBM Storwize V7000 for Lenovo changes upon creation of the first compressed volume in an I/O group. Be sure to review your existing system CPU resources before creating a compressed volume in an I/O group. While reviewing system resources, make sure the CPU utilization is lower.

Configure a balanced system

Do not configure only a few compressed volumes in an I/O group. This guideline is more applicable to systems with more than a single I/O group. For example, consider the following 4-node IBM Storwize V7000 for Lenovo (two I/O groups) with 200 volumes:

► iogrp0: Nodes 1 and 2; 180 compressed volumes
► iogrp1: Nodes 3 and 4; 20 compressed volumes

This setup is not ideal because CPU and memory resources are dedicated for compression use in all four nodes; however, in nodes 3 and 4, this allocation is used only for servicing 20 volumes out of 200 compressed volumes.

The following two alternatives are expressed in Table 2 (X is "a number of"):

► Alternative 1: migrate all compressed volumes from iogrp1 to iogrp0.

► Alternative 2: migrate compressed volumes from iogrp0 to iogrp1 and load balance across the nodes.

Table 2   Alternative setups

	Node 1	Node 2	Node 3	Node 4
Original setup	► 90 compressed volumes ► X non-compressed volumes	► 90 compressed volumes ► X non-compressed volumes	► 10 compressed volumes ► X non-compressed volumes	► 10 compressed volumes ► X non-compressed volumes
Alternative 1	► 100 compressed volumes ► X non-compressed volumes	► 100 compressed volumes ► X non-compressed volumes	► X compressed volumes ► X non-compressed volumes	► X compressed volumes ► X non-compressed volumes
Alternative 2	► 50 compressed volumes ► X non-compressed volumes	► 50 compressed volumes ► X non-compressed volumes	► 50 compressed volumes ► X non-compressed volumes	► 50 compressed volumes ► X non-compressed volumes

Usage scenarios and best practices

The remainder of this document lists recommended usage scenarios and best practices.

Converting non-compressed volumes to compressed volumes

Use volume mirroring to convert a volume from non-compressed to compressed (or vice versa).

► Use a maximum sync rate setting (100) if possible.

► Mirroring many volumes concurrently increases Compression CPU utilization. Mirroring to compressed volume is used as the method to convert from non-compressed to compressed. Do not do all conversions at once. Consider staging only a few mirrors at a time.

Evaluating performance for volumes targeted for compression

If the compression savings are in below 25%, evaluate the performance of the volume using the following steps:

1. Add a second compressed copy to the volume.

2. Mark the new compressed copy as primary.

3. Monitor the application performance and host performance to evaluate whether performance is acceptable. If the impact is unacceptable, delete the compressed copy to restore the original performance.

Converting an external MDisk to a compressed volume

An image mode volume provides a direct block-for-block translation from a managed disk (MDisk) to a volume with no virtualization. Image mode enables you to import external LUNs with existing data into the SAN Volume Controller or IBM Storwize V7000 for Lenovo as-is. An image mode volume can then be compressed by adding a mirrored compressed volume copy in a different storage pool.

To import an external LUN to an image mode volume, use the following steps:

1. Map the external LUN to IBM Storwize V7000 for Lenovo.

2. Create an empty MDisk Group:

   `mkmdiskgrp -name import_mdg`

3. Create an image mode volume in the MDisk Group you created in step 2. In the command, specify the external LUN as the MDisk. The volume should be the same size of the original LUN:

   `mkvdisk -vtype image -mdisk 13 -mdiskgrp import_mdg -size 1 -unit tb -rsize auto -iogrp0`

4. Now you can mirror this volume to a compressed volume:

   `addvdiskcopy -compressed -mdiskgrp striped -rsize 2% -autoexpand`

FlashCopy

Note the following information:

► Grainsize: the IBM FlashCopy default grainsize is 256 KB for non-compressed volumes, and 64 KB for compressed volumes. The preference is to use the default grainsize for compressed volumes.

► Consider using the background copy method: The two ways to use FlashCopy are with or without background copy.

– Without background copy, the host I/O is pending until the "split" event is finished. For example, if the host sends a 4 KB write, this I/O will wait until the corresponding grain (64 KB or 256 KB) is read and decompressed, and then it is written to the FlashCopy target copy. This adds latency to every I/O.

– With background copy, all the grains are copied to the FlashCopy target immediately after the FlashCopy mapping is created. This adds latency during the copy; however, it eliminates latency after the copy is complete.

Easy Tier

IBM Easy Tier is supported with compressed volumes starting with software version 7.1.0.1. The performance improvement achieved with Easy Tier and compression is up to three times faster in terms of application response time.

Easy Tier with compressed volumes tracks only read operations and migrates hot-extents to SSDs. Therefore, a good approach is to enable Easy Tier on compressed volumes with high read workloads.

If, for any reason, Easy Tier must be disabled on a certain volume, disable it by using the following command:

```
svctask chvdisk –easytier off volume_name
```

The performance improvement achieved with Easy Tier and compression is up to three times faster in terms of application response time by having 5% of SSDs in the configuration. Throughput (maximum IOPS) is dependent on compression CPU utilization; therefore, in most cases it remains the same.

Figure 1 on page 6 shows the test results of a TPC-C benchmark on compressed volume with Easy Tier enabled and disabled. The TPC-C benchmark was used with an Oracle database and represents a realistic online transaction processing (OLTP) workload.
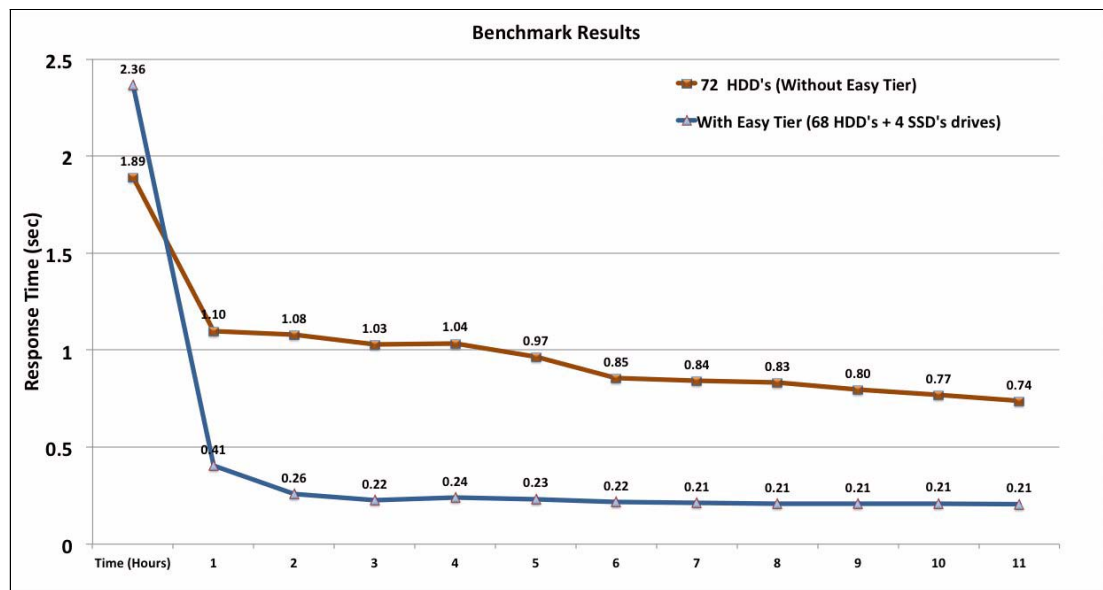

Figure 1   TPC-C benchmark results

The test results show that application response time became faster by more than three times when the configuration used SSDs with Easy Tier, compared to a similar configuration without SSDs and Easy Tier. IBM Storwize V7000 for Lenovo system used in the benchmark was running software version 7.1.0.1 and was using the disk configuration without and with Easy Tier.

- ► Without Easy Tier:
  - – 72 x 300 GB SAS HDDs
- ► With Easy Tier:
  - – 68 x 300 GB SAS HDDs
  - – 4 x 300 GB SAS SSDs

Related information

For more information, see the Lenovo Press product guide for the IBM Storwize V7000 for Lenovo, available from:

https://lenovopress.com/tips1302-ibm-storwize-v7000-for-lenovo

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