

# DELL EMC UNITY: COMPRESSION

## Overview

### **ABSTRACT**

This white paper is an introduction to the Dell EMC™ Unity Compression feature. It provides an overview of the feature, methods for managing compression, and interoperability with other Dell EMC Unity features. This paper is only applicable to systems running Dell EMC Unity OE versions prior to the 4.3 release that support compression.

In Dell EMC Unity OE version 4.3 and later, Dell EMC Unity Data Reduction replaces Dell EMC Unity Compression. Data reduction includes compression and deduplication logic within the space savings algorithm. For full details on data reduction, refer to the Dell EMC Unity Data Reduction white paper, found on Dell EMC Online Support.

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## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>4</b>
Audience .....	4
Terminology.....	4
<b>DELL EMC UNITY COMPRESSION LICENSING .....</b>	<b>5</b>
<b>OVERVIEW .....</b>	<b>5</b>
Supported Configurations.....	5
Theory of Operation .....	6
<b>MANAGEMENT .....</b>	<b>9</b>
Creating a Compression Enabled Storage Resource.....	10
Enabling and Disabling Compression on an Existing Storage Resource .....	16
How To Determine Which Storage Resources Have Compression Enabled .....	23
Compress Now.....	28
Savings Reporting.....	31
<b>INTEROPERABILITY .....</b>	<b>36</b>
Data at Rest Encryption .....	36
Replication .....	36
Snapshots .....	37
Thin Clones .....	37
Dell EMC Unity Native File and Block Import .....	37
Pool Expansion .....	37
<b>CONCLUSION .....</b>	<b>38</b>
<b>REFERENCES.....</b>	<b>39</b>

## EXECUTIVE SUMMARY

Data reduction technologies play a critical role in environments in which storage administrators are attempting to do more with less. Dell EMC Unity Compression aids in this effort by attempting to reduce the amount of physical storage needed to save a dataset, which helps reduce the Total Cost of Ownership of a Dell EMC Unity storage system. Dell EMC Unity Compression is easy to manage, and once enabled, is intelligently controlled by the storage system. Configuring compression and reporting savings is simple, and can be done through Unisphere, Unisphere CLI, or REST API.

This white paper discusses the Dell EMC Unity Compression feature, including information on how compression works, how to manage compression on supported storage resources, how to view compression savings, and the interoperability of compression with other features of the storage system. Best Practices information for using Dell EMC Unity Compression, along with information on when to enable compression, can be found in the *Dell EMC Unity: Best Practices Guide* white paper found on Dell EMC Online Support.

## AUDIENCE

This white paper is intended for customers, partners, and employees who are planning to utilize Dell EMC Unity Compression. It assumes familiarity with Dell EMC Unity and Dell EMC Unity's management software.

## TERMINOLOGY

**All Flash Pool** – A Pool which contains only Flash Drives. An All Flash Pool can be a Traditional Pool or a Dynamic Pool.

**Asynchronous Replication** – A replication method which allows you to replicate data over long distances, and maintain a replica at a destination site. Updates to the destination image can be issued manually, or automatically based on a customizable Recovery Point Objective (RPO).

**Block Storage Resources** – LUNs, LUNs within a Consistency Group, and VMware VMFS Datastores.

**Compression** – A data reduction method which reduces the physical amount of storage required to save a dataset.

**Consistency Group** – A storage instance which contains one or more LUNs within a storage system. Consistency Groups help organize the storage allocated for a particular host or hosts. Data protection configurations, such as replication and snapshot settings, on a Consistency Group affect all the LUNs contained in the group, providing ease of management and crash consistency if the LUNs are dependent on each other.

**Data at Rest Encryption (D@RE)** – The process of encrypting data and protecting it against unauthorized access unless valid keys are provided. This prevents data from being accessed and provides a mechanism to quickly crypto-erase data.

**File Storage Resources** – File Systems (NFS, SMB) and VMware NFS Datastores.

**Flash drive (SSD)** – A Flash based storage device used to store data.

**Hard Disk Drive (HDD)** – A storage device based on spinning platters used to store data.

**Hybrid Pool** – A Pool which does not contain only Flash Drives. A Hybrid Pool typically contains more than one type of drive technology, such as Flash, SAS, and NL-SAS.

**LUN** – A block based storage resource which a user provisions. It represents a SCSI logical unit.

**Pool** – A set of drives that provide specific storage characteristics for the resources that use them, such as LUNs, VMware Datastores, and File Systems.

**REST API** – An application programming interface that utilizes familiar HTTP operations like GET, POST, and DELETE. REST architecture includes certain constraints that ensure that different implementations of REST conform to the same guiding principles, thereby allowing developers the ease of application development when working with different REST API deployments.

**Snapshot** – A snapshot, also called a Dell EMC Unity Snapshot, is a point-in-time view of a storage resource. When a Snapshot is taken, the snapshot is an exact copy of the source storage resource, and shares all blocks of data with it. As data changes on the source, new blocks are allocated and written to. Dell EMC Unity Snapshot technology can be used to take a snapshot of a Block or File storage resource.

**Storage Resource** – An addressable and configurable storage instance associated with a specific quantity of storage. LUNs, File Systems, and VMware Datastores constitute storage resources.

**System Cache (DRAM Cache)** – Dell EMC Unity software component which leverages DRAM memory to improve host read and write performance.

**Thin Clone** – A read-write copy of a Thin Block storage resource (LUN, Consistency Group, or VMware VMFS Datastore) that shares blocks with the parent resource.

**Unisphere** – A web-based management environment used to create storage resources, configure and schedule protection for stored data, and manage and monitor other storage operations.

**Unisphere CLI (UEMCLI)** – The command line interface for managing Dell EMC Unity storage systems.

## DELL EMC UNITY COMPRESSION LICENSING

Dell EMC Unity Compression is licensed with all physical Dell EMC Unity systems at no additional cost. Compression is not available on the Dell EMC UnityVSA version of the Dell EMC Unity platform as compression requires write caching within the system. To use compression with Block Storage Resources such as Thin LUNs, Thin LUNs within a Consistency Group, and Thin VMware VMFS Datastores, the system must be running Dell EMC Unity OE version 4.1 or later. In Dell EMC Unity OE version 4.2 and later, compression support was added for Thin File Storage Resources created on Dell EMC Unity OE version 4.2 or later code. For systems running a version of Dell EMC Unity OE older than this revision, upgrading the system will license the compression feature automatically, with no additional steps needed. Once the Dell EMC Unity OE has been upgraded, compression enabled storage resources can be created, or compression can be enabled on existing storage resources which support compression.

To verify which version of Dell EMC Unity OE your system is running, simply select the **View System Status** icon found on the top blue menu bar of Unisphere. Alternatively, you can check the license status for Dell EMC Unity Compression by clicking the **Update System Status** icon, denoted by a gear icon on the top blue menu bar, and finding **Compression** in the **License Management** list. An entry of **Compression** and a green checkmark besides it confirms the feature is licensed on the system.

## OVERVIEW

The Dell EMC Unity family of storage systems are feature rich, easy-to-use, and deliver full Block and File unified environments starting in a single 2U enclosure. To help reduce the total cost of ownership and increase the efficiency of a Dell EMC Unity storage system, Dell EMC Unity Compression has been added in Dell EMC Unity OE version 4.1, and initially supports Thin Block storage resources. Thin File storage resource support was added in Dell EMC Unity OE version 4.2. With compression, the amount of space required to store a dataset for compression enabled storage resources is reduced when savings are achieved. This space savings reduces the amount of physical storage required to store a dataset, which can lead to cost savings. Compression savings are not only achieved on the storage resource it is enabled on, but space savings is also realized on Snapshots and Thin Clones of those resources as well. Snapshots and Thin Clones inherit the compression setting of the source storage resource, which helps to increase the space savings that they can provide. Thin Clones were released in Dell EMC Unity OE version 4.2 and later.

## SUPPORTED CONFIGURATIONS

In Dell EMC Unity OE version 4.1 and later, compression is supported on Thin LUNs, Thin LUNs within a Consistency Group, and VMware VMFS Datastores, if the storage resource is provisioned from an All Flash Pool. All Flash Pools can be created on a Dell EMC Unity Hybrid Flash System, or a Dell EMC Unity All Flash system. In Dell EMC Unity OE version 4.2 a new Pool type, named Dynamic Pools, was released for Dell EMC Unity All Flash Systems. Compression is fully supported with this new Pool type. Within a Consistency Group, compression enabled LUNs can be mixed with LUNs which have compression disabled.

In Dell EMC Unity OE version 4.2 and later, compression support was added for Thin File Systems (SMB/NFS) and Thin VMware NFS Datastores. To support compression, Thin File storage resources must be created on Dell EMC Unity OE version 4.2 or later and be created within an All Flash Pool. In the 4.2 release, multiple architecture changes were made to allow File storage resources to support compression. File storage resources created on Dell EMC Unity OE versions prior to version 4.2 do not support compression.

Dell EMC Unity Compression can be enabled on supported storage resources at the time of the resource's creation, or enabled or disabled at a later time. Local LUN Move, introduced in Dell EMC Unity OE version 4.1 for Block storage resources, can be leveraged to move uncompressed data into a compression enabled LUN within an All Flash Pool. For File storage resources, there is no direct method available to convert from a pre-Dell EMC Unity OE 4.2 File resource to a 4.2 or later File resource. Methods to move File data include host-based migration to a Dell EMC Unity OE 4.2 or later File System or VMware VMotion for VMs created on NFS Datastores. For more information on enabling or disabling compression on supported storage resources, view the *Management* section within this paper.

Dell EMC Unity Compression can also be enabled on Block and File storage resources participating in replication sessions. The source and destination storage resources in a replication session are completely independent, and compression can be enabled or disabled separately on the source and destination resource. The availability of enabling compression on a source and/or a destination resource depends on the Dell EMC Unity OE version, the system type, and the Pool configuration.

Pools containing compression enabled storage resources cannot be expanded with SAS or NL-SAS. For more information about expanding Pools and how to convert to a Hybrid Flash Pool, please review the *Pool Expansion* section found under *Interoperability*.

## THEORY OF OPERATION

Dell EMC Unity Compression works the same for both Block and File storage resources. Compression utilizes a software algorithm to analyze and compress data within a storage resource. Figure 1 below is a high level diagram of a storage resource with compression enabled residing within an All Flash Pool. As shown in Figure 1, compression occurs inline between System Cache and the storage resource on an All Flash Pool.

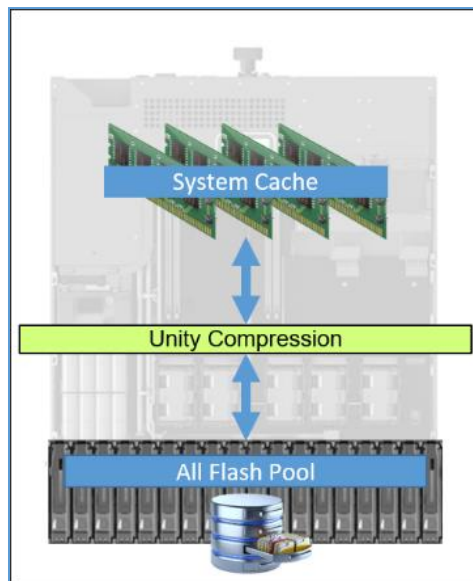
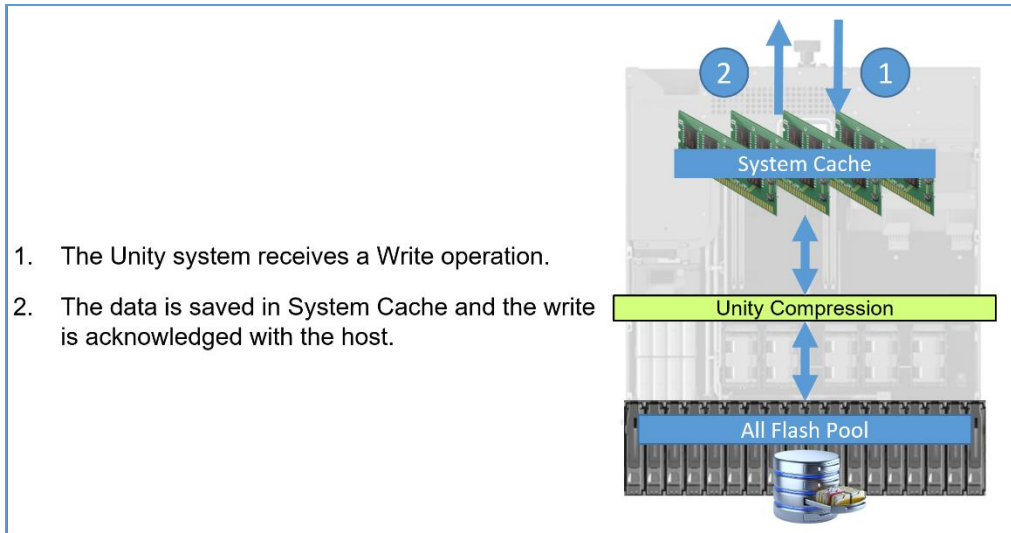


Figure 1. Dell EMC Unity Compression Overview

When data is written to the system, the data is saved in System Cache, and the write is acknowledged with the host. The compression process is not invoked for write I/Os at this point in time in order to provide the fastest response to the host. Figure 2 below outlines an example of a write to a storage resource with compression enabled. No data has been written to the drives within the Pool at this time.

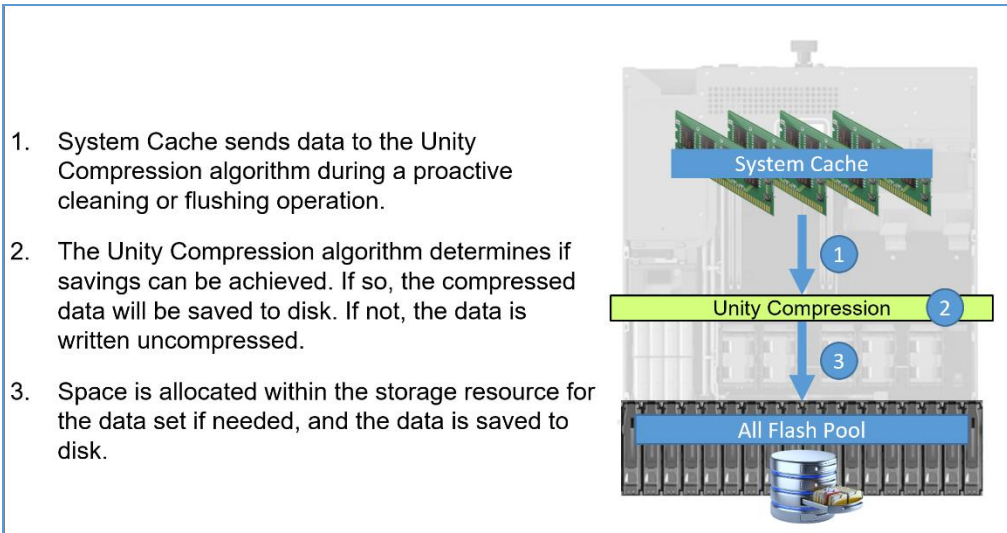


**Figure 2. Host Write Example**

In Dell EMC Unity, before a write is saved in system cache, the system ensures space is available and allocated for the I/O within the target storage resource. In Dell EMC Unity OE version 4.1 and later, the write caching process has been enhanced and all back-end allocations and lookups within the target storage resource are deferred until after writes are accepted into System Cache and the host is acknowledged. To ensure all data in cache is backed by disk, a portion of the private space within the storage resource's overhead is tracked and utilized as a possible location to store the I/O when accepting data into cache. A storage resource's private space is allocated at time of the storage resource's creation, and no additional space is allocated after upgrading to Dell EMC Unity OE version 4.1 or later for storage resources created on earlier codes. After the I/O is acknowledged, the normal cache cleaning process occurs. Space within the storage resource is utilized or allocated, if needed, and the data is saved to disk. This caching change not only applies to compression enabled resources, but it is also applicable to Block and File storage resources (excluding VVols) created on All Flash Pools.

For compression enabled storage resources, compression occurs during the System Cache's proactive cleaning operations or when System Cache is flushing cache pages to the drives within the Pool. The data in this scenario may be new to the storage resource, or the data may be an update to existing blocks of data currently residing on disk. In either case, the data compression algorithm occurs before the data is written to the drives within the Pool. During the compression process, multiple blocks are aggregated together and sent through a sampling algorithm, which determines if the data can be compressed. If the sampling algorithm determines a sufficient amount of space can be saved, the proper amount of space is then allocated within the storage resource and the data is compressed and written to the Pool. Compression will not compress data if the size of the compressed data and overhead to store the data is greater than the original data size. Waiting to allocate space within the resource until after the compression estimate is completed helps to not over-allocate space within the storage resource.

The compression operation is outlined in Figure 3 below. If the sampling algorithm determines only minimal savings can be achieved, compression is skipped and the data is written to the Pool as if compression is disabled. By compressing data before it is written to disk, drive operations are greatly reduced. Compression also helps to reduce flash wear, by reducing the physical amount of data being written to disk.



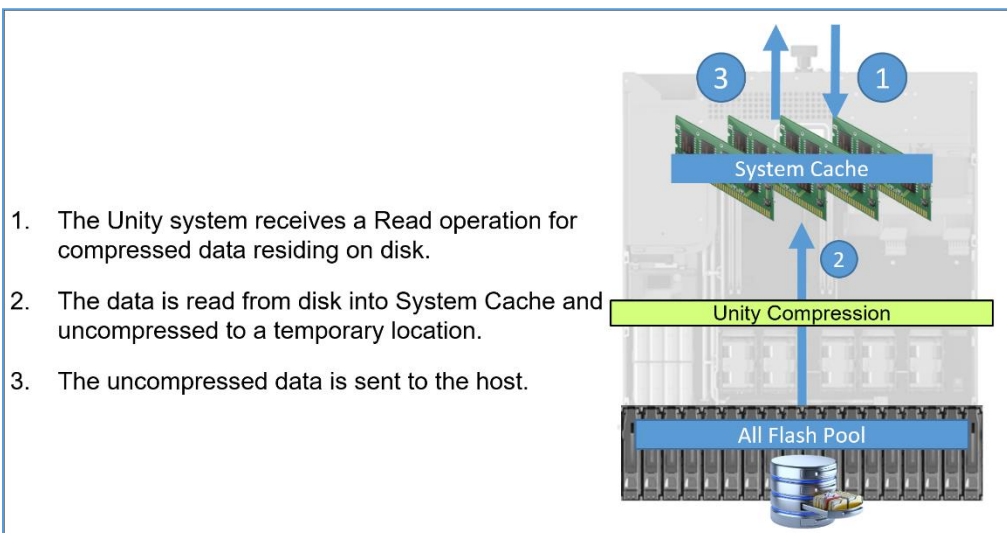
1. System Cache sends data to the Unity Compression algorithm during a proactive cleaning or flushing operation.
2. The Unity Compression algorithm determines if savings can be achieved. If so, the compressed data will be saved to disk. If not, the data is written uncompressed.
3. Space is allocated within the storage resource for the data set if needed, and the data is saved to disk.

**Figure 3. Dell EMC Unity Compression Example**

When writing data to the Pool, space must be allocated within a storage resource to match the size of the data being written. All new writes require space to be allocated within the storage resource. In the case of overwriting existing data, if the amount of compression savings changed since the last time the data was written, then new space must be allocated within the storage resource to store the new data size. This is true if the data set is now larger than it was previously. If the data set size hasn't changed or is smaller than it was previously, then a write to an already allocated block may occur. In the background, the old locations that are no longer needed are freed by a cleanup process and can be reused. This process also frees blocks no longer in use by the storage resource and its Snapshots or Thin Clones. If enough space is freed within a 256 MB slice, the slice can be freed back to the Pool.

When read operations are received, the current location of the data being requested and the compression state is determined. If the data is not compressed, a normal read operation occurs as if compression is disabled on the storage resource. If the data resides in System Cache, the data is sent to the host. If the data resides on disk, the data is copied into System Cache and then sent to the host requesting the data.

If the data is compressed, it must first be uncompressed before the data is sent to the host. This process is outlined in Figure 4 below. If the compressed data already resides in System Cache, the data is uncompressed to a temporary location, the data is sent to the host, and the temporary location is released. If the compressed data being requested resides on disk, the data is first read into System Cache, uncompressed to a temporary location, and the host is sent the data. Data is never uncompressed on disk due to a read operation, as this would reduce the amount of savings on the storage resource.



1. The Unity system receives a Read operation for compressed data residing on disk.
2. The data is read from disk into System Cache and uncompressed to a temporary location.
3. The uncompressed data is sent to the host.

**Figure 4. A read operation to compressed data on disk**

## CREATING COMPRESSION ENABLED STORAGE RESOURCES

Dell EMC Unity Compression enabled Block and File storage resources can be created using Unisphere, Unisphere CLI (UEMCLI), or REST API. When creating compression enabled LUNs in Unisphere, one or more LUNs can be created at the same time using the



Create LUNs wizard, which is found on the Block page. When creating storage resources using Unisphere CLI or REST API, an extra option for enabling compression is available. Compression enabled LUNs are also supported within Consistency Groups. Compressed LUNs and non-compressed LUNs can reside within the same Consistency Group. Compression enabled File Systems can also reside within a NAS Server with File Systems with compression disabled.

## **ENABLING COMPRESSION ON AN EXISTING STORAGE RESOURCE**

Dell EMC Unity Compression can be enabled on a supported storage resource at any point in time. This can be completed in Unisphere from the properties window of the storage resource, or by utilizing Unisphere CLI or REST API. After upgrading to Dell EMC Unity OE version 4.1 or later, the user has the option to enable compression on Thin Block storage resources on an individual basis. In OE version 4.2 or later, the user has the option to enable compression on Thin File storage resources created on Dell EMC Unity OE version 4.2 or later. Enabling compression on File storage resources created prior to Dell EMC Unity OE 4.2 is not supported. When compression is enabled on an existing resource, no data on the storage resource is compressed at that time. All previously written data is left in its uncompressed state, and only new writes or overwrites are considered for compression. To compress existing data within a Block storage resource, the user can utilize the Compress Now option, which is outlined below. Compress Now is not supported on File storage resources.

## **LOCAL LUN MOVE AND COMPRESS NOW**

Local LUN Move, a feature introduced in Dell EMC Unity OE version 4.1 for Block storage resources, is used to move data from a supported source Block storage resource to a target Block storage resource within the same system. The Local LUN Move operation is completely transparent to any associated hosts, and no interruption to access is seen. Local LUN Move can be utilized to move a storage resource from one Pool to another, or within the same Pool. When utilizing the Local LUN Move feature, the Session Priority and destination Pool may be customized. You can also move to a compression enabled resource if the destination Pool is an All Flash Pool and the storage resource supports compression. A Local LUN Move session can be cancelled at any time. For more information on Local LUN Move and any restrictions of its usage, refer to the white paper titled *Dell EMC Unity: Migration Technologies* on Dell EMC Online Support.

Compress Now, a feature introduced in Dell EMC Unity OE version 4.1, is used to compress existing data within a compression enabled Thin Block storage resource. This feature is only available for compression enabled Block storage resources. When selected, the Compress Now operation automatically starts a Local LUN Move process to a compression enabled storage resource residing within the same Pool. As the Local LUN Move operation copies data to a compression enabled storage resource, the data is compressed. The Compress Now operation is most commonly utilized after enabling compression on an existing storage resource to attain compression savings on existing data. Compress Now is not available on the Dell EMC Unity 350F, 450F, 550F, and 650F system models.

The Compress Now option may be utilized at any time, not only after enabling compression on a storage resource. One benefit to utilizing Compress Now is that it sequentially moves data to a new storage resource. This reorganization can help to improve performance of sequential workloads if the data was originally written randomly to the resource. The reorganization may also increase the savings achieved by compression by putting compressible data sequentially together. For maximum space savings, it is recommended that only 1 Compress Now operation per Storage Processor be running on the system at a time.

As with other features, Local LUN Move can be managed in Unisphere, Unisphere CLI, and REST API. The Compress Now option is only available within Unisphere, and is only a method to start a Local LUN Move operation to a compression enabled storage resource within the same Pool.

## **DISABLING COMPRESSION ON A RESOURCE**

As with enabling compression on a storage resource, compression can be disabled at any point in time on a supported storage resource. This can be completed in Unisphere from the properties window of the storage resource, or by utilizing Unisphere CLI or REST API. After compression is disabled, all data for the storage resource is left its current state within its Pool, whether it is compressed or not. Data written after disabling compression will be stored as uncompressed. As previously compressed data is overwritten, compression savings are reduced on the storage resource. To fully remove compression savings from a Block storage resource, Local LUN Move can be utilized by specifying a non-compressed destination.

## **MANAGEMENT**

Creating and managing Dell EMC Unity Compression from Unisphere, Unisphere CLI, and REST API is easy and intuitive. The following sections outline how to create a compression enabled storage resource, how to enable and disable compression, how to

determine the current state of compression on a resource, how to use Compress Now, and where compression savings are reported. Unisphere examples for each of these areas will be shown, along with examples from Unisphere CLI. For more information on using the Unisphere CLI, refer to the *Unisphere Command Line Interface User Guide* on Dell EMC Online Support. For information on managing Dell EMC Unity Compression from REST API, consult the REST API documentation which can be accessed directly from any Dell EMC Unity system:

**REST API Programmer's Guide** – [https://<Management\\_IP>/apidocs/programmers-guide/index.html](https://<Management_IP>/apidocs/programmers-guide/index.html)

**REST API Reference Guide** – [https://<Management\\_IP>/apidocs/index.html](https://<Management_IP>/apidocs/index.html)

Where <Management\_IP> is the management IP of your system.

## CREATING A COMPRESSION ENABLED STORAGE RESOURCE

Dell EMC Unity Compression is supported on Thin LUNs, whether standalone or within a Consistency Group, Thin File Systems, and VMware VMFS and NFS Datastores created on All Flash Pools. Each of these storage resources can be created using Unisphere, Unisphere CLI, or REST API. The following sections outline how you can easily create compression enabled storage resources using Unisphere and Unisphere CLI.

### LUNS

In Unisphere, standalone Thin LUNs are created using the **Create LUNs** wizard, which can be found on the **Block** page. The **Block** page can be accessed by selecting **Block** under **Storage** in the left Unisphere pane. Figure 5 below shows the **Create LUNs** wizard, which has been updated in the Dell EMC Unity OE version 4.2 release. In Dell EMC Unity OE version 4.1 and later, multiple LUNs can be created at the same time, and an option to enable compression on the LUNs has been added. In Dell EMC Unity OE version 4.2 and later, Thin and Thick LUNs can be created within Unisphere. To create a compression enabled LUN or multiple compression enabled LUNs, ensure the **Thin** and **Compression** checkboxes are checked in the **Configure** step. After customizing the other settings of the LUN, click **Next**.

**Figure 5. Create LUN Wizard – Configure Step**

After configuring the other settings of the LUN(s), the **Summary** step is displayed. An example of the **Summary** step when creating multiple compression enabled LUNs is shown in Figure 6. The Summary screen has also been updated to include the **Name(s)** of the LUNs being created, and if **Compression** will be enabled on the new LUNs.

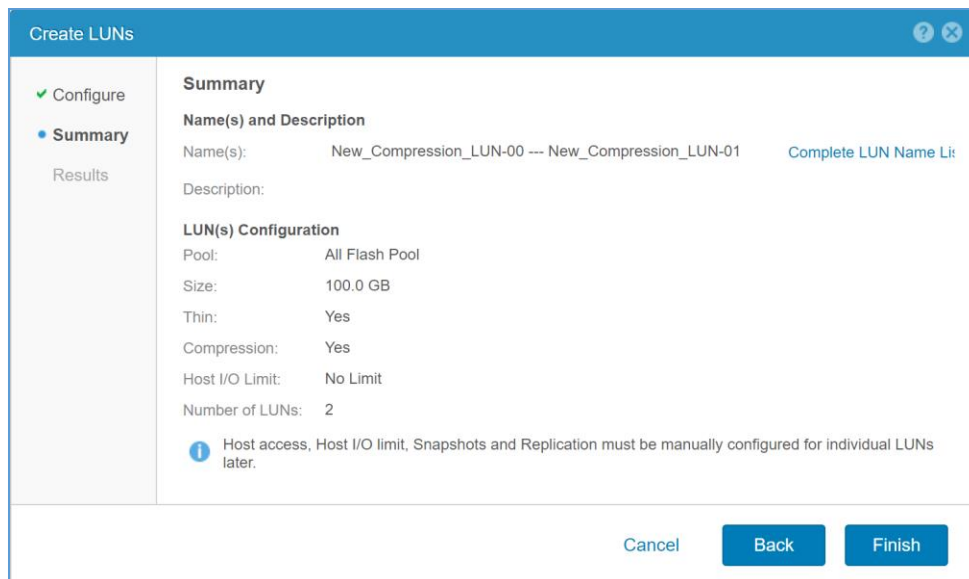


Figure 6. Create LUN Wizard – Summary Step

Unisphere CLI can also be used to create a new LUN with compression enabled. In codes which support compression, a new **-compression** option has been added to the `/stor/prov/luns/lun create` command. Below is the usage of the `/stor/prov/luns/lun create` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun -help
```

LUN

Actions:

[Create]

```
/stor/prov/luns/lun create [ -async ] -name <value> [ -descr <value> ] [ -type { primary | tc
-source <value> } ] [ -group <value> ] [ -pool <value> ] [ -size <value> ] [ -thin { yes | no } ]
[ -sched <value> [ -schedPaused { yes | no } ] ] [ -spOwner { spa | spb } ] [ -lunHosts <value> ]
[ -snapHosts <value> ] [ -replDest { yes | no } ] [ -compression { yes | no } ] [ -ioLimit <value>]
```

Below is an example of creating a compression enabled LUN using Unisphere CLI.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun create -name New_Compression_LUN
-pool pool_1 -size 250G -thin yes -compression yes
```

```
ID = sv_35
```

```
Operation completed successfully.
```

## CONSISTENCY GROUPS

When creating a new Consistency Group, compression enabled Thin LUNs can also be created. Consistency Groups can be created and configured by navigating to the **Consistency Group** tab within the **Block** page. The **Configure LUNs** window, shown below in Figure 7, has been updated to allow the creation of compression enabled LUNs. To create compression enabled LUNs within a Consistency Group, ensure the **Thin** and **Compression** boxes are checked before clicking **OK**.

**Figure 7. Configure LUNs step within the Create a Consistency Group Wizard**

After configuring LUNs within the Consistency Group, the **Storage** screen within the **Create a Consistency Group** wizard is populated. An example of this window is shown in Figure 8. From this screen you can see if the LUNs being created have compression enabled or not by reviewing the **Compression** column. The **Compression** column is not enabled by default, but can be added to the view by clicking the **Gear Icon** and clicking the checkbox next to **Compression** under the **Columns** option.

	LUNs	Action	LUN Name	Size (GB)	Thin	Pool
<input type="checkbox"/>	2	Create	New_CG_LUNs	100.0	Yes	All Flash Pool

**Figure 8. Create a Consistency Group - Populate a Consistency Group screen**

When utilizing Unisphere CLI to create a Consistency Group and populate it, the Consistency Group must be created first before adding LUNs. Below is the usage of the `/stor/prov/luns/group create` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/group -help
```

Consistency group  
Actions:

```
[Create]
/stor/prov/luns/group create [ -async ] -name <value> [ -descr <value> ] [ -type { primary | tc
-source <value> } ] [ -sched <value> [ -schedPaused { yes | no } ] ] [ -replDest { yes | no } ]
```

Below is an example of creating a Consistency Group using Unisphere CLI.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/group create -name CG4
```

```
ID = res_8
```

```
Operation completed successfully.
```

After the Consistency Group is created, a compression enabled LUN can be created and added to the previously created Consistency Group with the `-group` option. Below is an example command to accomplish this.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun create -name New_CG_Compression_LUN  
-group res_8 -pool pool_1 -size 250G -thin yes -compression yes
```

```
ID = sv_36
```

```
Operation completed successfully.
```

## FILE SYSTEMS

In Dell EMC Unity OE version 4.2, compression support was added for Thin File Systems created on Dell EMC Unity OE version 4.2 and later. In Unisphere, Thin File Systems are created using the **Create a File System** wizard, found on the **File** page. The **File** page can be accessed by selecting **File** under **Storage** in the left pane of Unisphere. Figure 9 below shows the **Storage** step within the **Create a File System** wizard, which has been updated in the Dell EMC Unity OE version 4.2 release. In this release and later, a File System can be created with Compression enabled. To enable compression, first ensure the **Thin** checkbox is checked, as compression is only available on Thin File Systems. Second, select the **Compression** checkbox, which is disabled by default. After customizing the other settings of the File System, click **Next**.

The screenshot shows the 'Create a File System' wizard in the 'Storage' step. The left sidebar lists the steps: Protocol, Name, Storage (selected), Shares, Snapshot, Replication, Summary, and Results. The main content area is titled 'Configure the File System Storage Characteristics'. It includes a 'Pool' dropdown menu set to 'All Flash Pool (Extreme Performance Tier, 35.9 TB free)'. Below that, the 'Size' is set to '100' with a unit dropdown set to 'GB'. There are two checked checkboxes: 'Thin' and 'Compression'. At the bottom right, there are 'Cancel', 'Back', and 'Next' buttons.

Figure 9. Create a File System Wizard – Storage Step

After configuring the other File System settings, the **Summary** step is displayed. This is the last step before the creation of the File System. An example of the **Summary** step can be seen in Figure 10. The **Summary** screen has also been updated to include **Compression**, which signifies if the File System will be configured with compression enabled (Yes) or disabled (No).

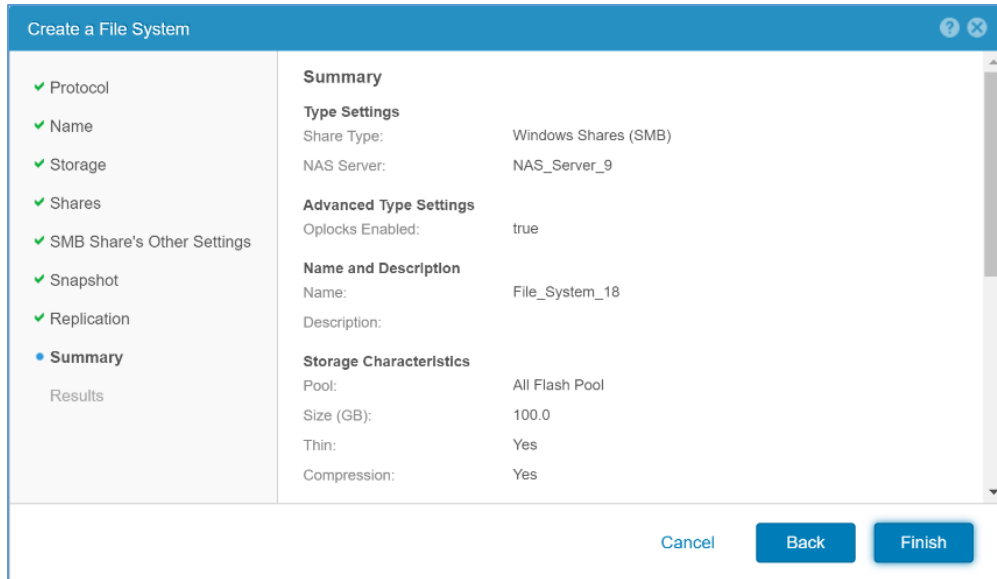


Figure 10. Create a File System Wizard – Summary Step

Unisphere CLI can also be used to create a new Thin File System with compression enabled. In Dell EMC Unity OE version 4.2, a new `-compression` option has been added to the `/stor/prov/fs create` command. Below is the usage of the `/stor/prov/fs create` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/fs create -help
```

```
+ - /stor/prov/fs/
    +- [nfs]
    +- [cifs]
```

File system  
Actions:

```
[Create]
/stor/prov/fs create [ -async ] -name <value> [ -descr <value> ] -server <value> -pool <value> -
size <value> [ -thin { yes | no } ] [ -compression { yes | no } ] -type { { cifs | multiprotocol
[ -accessPolicy { native | Windows | Unix } ] [ -folderRenamePolicy { allowedAll | forbiddenSmb |
forbiddenAll } ] [ -lockingPolicy { advisory | mandatory } ] } [ -cifsSyncWrites { yes | no } ]
[ -cifsOpLocks { yes | no } ] [ -cifsNotifyOnWrite { yes | no } ] [ -cifsNotifyOnAccess { yes | no
} ] [ -cifsNotifyDirDepth <value> ] | nfs } [ -fastvpPolicy { startHighThenAuto | auto | highest |
lowest } ] [ -sched <value> [ -schedPaused { yes | no } ] ] [ -replDest { yes | no } ]
[ -eventProtocols <value> ]
```

Below is an example of creating a compression enabled Thin File System using Unisphere CLI.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/fs create -name "FS14" -server nas_2 -pool
pool_1 -size 1T -thin yes -compression yes -type cifs
```

```
ID = res_63
Operation completed successfully.
```

## VMWARE VMFS AND NFS DATASTORES

In Dell EMC Unity OE version 4.1 and later, VMware VMFS Datastores can be created with compression enabled. VMware NFS Datastores created on Dell EMC Unity OE 4.2 and later also support compression. To create a VMware Datastore, first navigate to the **VMware** page, found by selecting **VMware** under **Storage** in the left Unisphere pane. While on the **VMware** page, select the + symbol on the **Datastores** tab to launch the **Create VMware Datastore** wizard. On the **Type** step, select **File** to create a VMware NFS Datastore, or **Block** to create a VMware VMFS Datastore. On the **Storage** step you can select which Pool to create the VMFS or NFS Datastore on, the size of the Datastore, if it will be Thin, and if compression is enabled. The Pool selected must be an All Flash Pool and the Thin checkbox must be selected for the Compression option to be available. An example of the **Storage** step when creating a VMware VMFS Datastore is found in Figure 11. The **Storage** step contains similar information when creating a VMware NFS Datastore.

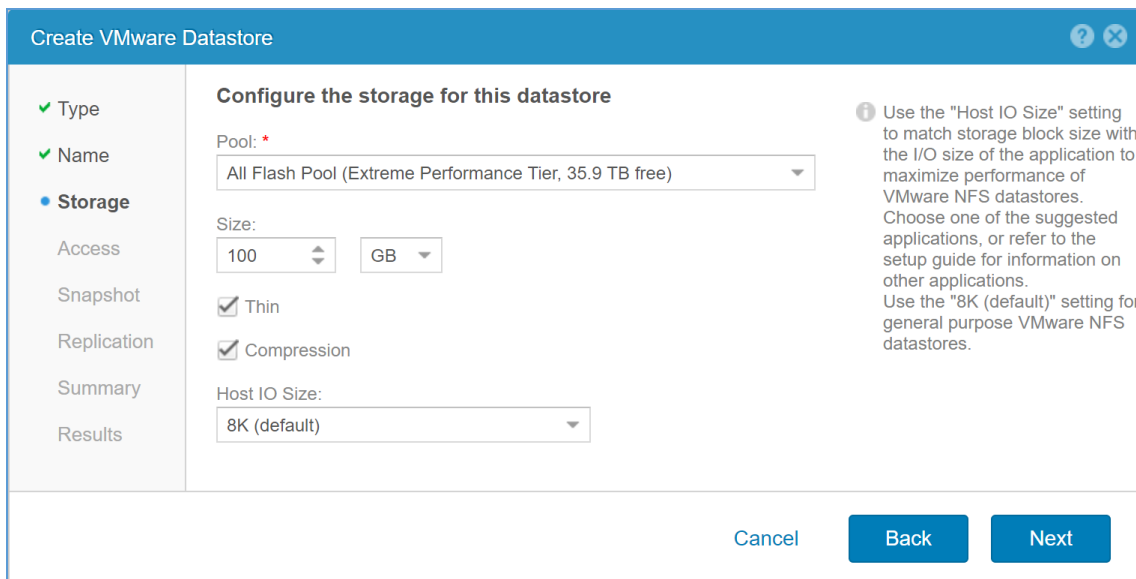


Figure 11. Create VMware VMFS Datastore Wizard – Storage Step

VMware VMFS Datastores can also be created using Unisphere CLI. In codes which support compression, a new `-compression` option has been added to the `/stor/prov/vmware/vmfs create` command. Below is the usage of the `/stor/prov/vmware/vmfs create` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/vmfs -help
```

VMware VMFS datastore

Actions:

```
[Create]
/stor/prov/vmware/vmfs create [ -async ] -name <value> [ -descr <value> ] [ -type { primary | tc
-source <value> } ] [ -pool <value> ] [ -size <value> ] [ -thin { yes | no } ] [ -sched <value> [
-schedPaused { yes | no } ] ] [ -spOwner { spa | spb } ] [ -replDest { yes | no } ] [ -compression
{ yes | no } ] [ -fastvpPolicy { startHighThenAuto | auto | highest | lowest } ] [ -vdiskHosts
<value> ] [ -snapHosts <value> ] [ -version { 3 -blockSize { 1 | 2 | 4 | 8 } | 5 } ] [ -ioLimit
<value> ]
```

Below is an example of creating a compression enabled VMware VMFS Datastore using Unisphere CLI.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/vmfs create -name
Compression_Enabled_VMFS_Datastore -pool pool_1 -size 1T -thin yes -compression yes
```

ID = res\_9

Operation completed successfully.

VMware NFS Datastores can also be created using Unisphere CLI. In codes which support compression, a new `-compression` option has been added to the `/stor/prov/vmware/nfs create` command. Below is the usage of the `/stor/prov/vmware/nfs create` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/nfs -help
```

Manage VMware Network Filesystem Share (NFS) datastores. NFS datastores provide file storage to ESX Server hosts through the NFS protocol.

Actions:

```
[Create]
/stor/prov/vmware/nfs create [ -async ] [ -format UFS64 ] -name <value> [ -descr <value> ] -pool
<value> -server <value> -size <value> [ -hostIOSize { 8K | 16K | 32K | 64K | exchange2007 |
exchange2010 | exchange2013 | oracle | sqlServer | vmwareHorizon | sharePoint | sap } ] [ -thin
{ yes | no } ] [ -compression { yes | no } ] [ -sched <value> [ -schedPaused { yes | no } ] ]
[ -defAccess { ro | rw | root | na } ] [ -roHosts <value> ] [ -rwHosts <value> ] [ -rootHosts
<value> ] [ -naHosts <value> ] [ -esxMountProtocol { NFSv3 | NFSv4 } ] [ -minSecurity { sys | krb5
```

```
[ -nfsOwner <value> ] } ] [ -replDest { yes | no } ] [ -eventProtocols <value> ] [ -fastvpPolicy { startHighThenAuto | auto | highest | lowest } ]
```

Below is an example of creating a compression enabled VMware NFS Datastore using Unisphere CLI.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/nfs create -name  
Compression_Enabled_NFS_Datastore -pool pool_1 -server nas_1 -size 1T -thin yes -compression yes
```

```
ID = res_40
```

```
Operation completed successfully.
```

## ENABLING AND DISABLING COMPRESSION ON AN EXISTING STORAGE RESOURCE

Dell EMC Unity Compression can be enabled or disabled on supported storage resources at any point in time. This can easily be accomplished using either Unisphere, Unisphere CLI, or REST API. The following sections outline how you can easily enable and disable compression on existing storage resources using Unisphere and Unisphere CLI.

### LUNS

To enable and disable compression on an existing LUN, review the properties of the LUN from the **Block** page. The **Block** page can be accessed by selecting **Block** under **Storage** in the left Unisphere pane. After double clicking the Name of the LUN, or after selecting a LUN and clicking the Pencil (View/Edit) icon, the LUN Properties window is displayed. On the **General** tab, a checkbox for **Compression** exists. Depending if compression is currently disabled or enabled on the storage resource, the box will either be unchecked or checked. To change the state of compression, simply check or uncheck the **Compression** box and click **Apply**.

Figure 12 below shows the Properties window of a LUN which currently has Compression disabled. This picture was specifically taken on a Broadwell CPU based model, and will apply to Dell EMC Unity 300(F), 400(F), 500(F), and 600(F) system. The Compression box has been selected to enable compression on the resource, but Apply has not yet been selected. When enabling compression on a resource, an informational message is displayed after checking the **Compression** box. The message states:

*All the incoming writes will be compressed. You may click "Compress Now" from More Actions on the LUN table to compress the incoming writes as well as the existing data. Click the help icon for information on "Compress Now" functionality.*

This message outlines that the Compress Now option must be used to compress the existing data within the storage resource if desired. If the Compress Now option is not utilized, then only new writes to the LUN or overwrites to existing data within the LUN are considered for compression. As the Dell EMC Unity 350F, 450F, 550F, and 650F systems do not support Compress Now, the message displayed on those system models is slightly different. The message on those models states:

*All the incoming writes will be compressed. Click the help icon for information on how to compress the incoming writes as well as the existing data.*



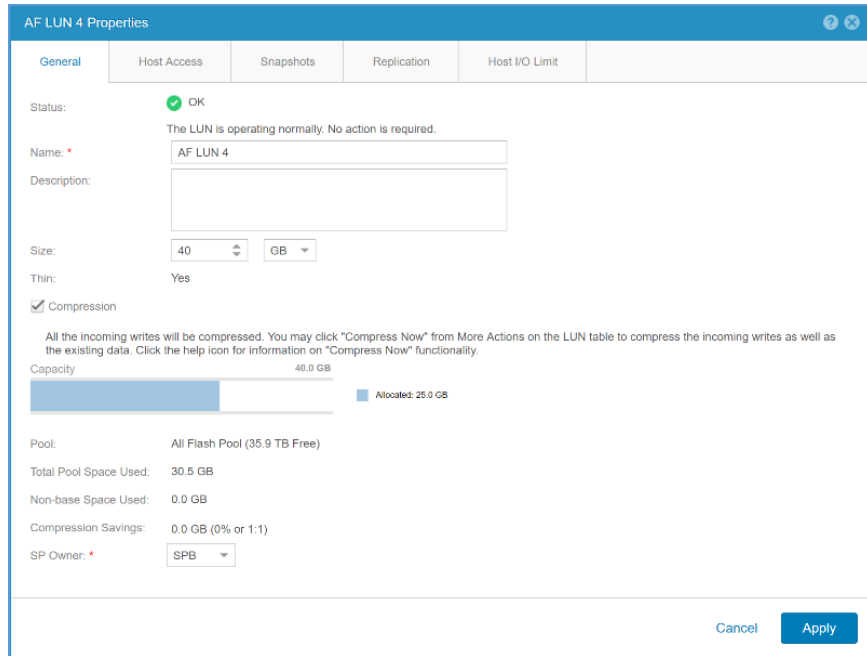


Figure 12. LUN Properties Window. Enabling Compression Example

Figure 13 below shows the Properties window of a LUN which currently has Compression enabled. The Compression box has been deselected to disable compression on the resource, but Apply has not yet been selected. When disabling compression on a resource, an informational message is displayed after unchecking the **Compression** box. The message states:

*Existing data will remain compressed. Newly written data will not be compressed.*

This message implies that the Local LUN Move option must be used to uncompress the existing data within the storage resource if desired. If the Local LUN Move option is not utilized, then only overwrites to the LUN will cause compression savings to decrease.

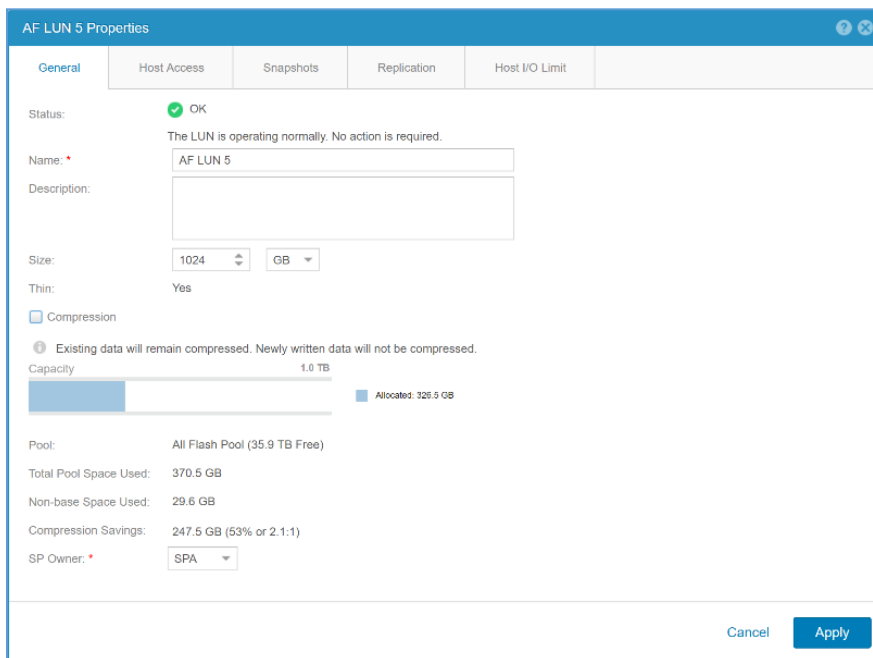


Figure 13. LUN Properties Window. Disabling Compression Example

Unisphere CLI can also be used to enable and disable compression on an existing LUN. In codes which support compression, a new `-compression` option has been added to the `/stor/prov/luns/lun set` command. Below is the usage of the `/stor/prov/luns/lun set` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun -help
```

LUN  
Actions:

```
[Set]
/stor/prov/luns/lun -id <value> set [ -async ] [ -name <value> ] [ -descr <value> ] [ -size <value>
] [ { -group <value> | -standalone } ] [ { -sched <value> | -noSched } ] [ -schedPaused { yes | no
} ] [ -spOwner { spa | spb } ] [ -fastvpPolicy { startHighThenAuto | auto | highest | lowest } ] [
-lunHosts <value> ] [ -snapHosts <value> ] [ -replDest { yes | no } ] [ -compression { yes | no } ]
[ { -ioLimit <value> | -noIoLimit } ]
```

Below is an example of enabling compression on an existing LUN named *AF LUN 1*, which has a CLI ID of *sv\_1*, using Unisphere CLI. Disabling compression is just as easy, and can be accomplished by simply swapping `-compression yes` for `-compression no`.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun lun -id sv_1 set -compression yes
```

ID = sv\_1  
Operation completed successfully.

## CONSISTENCY GROUP LUNS

Enabling and disabling compression on a LUN within a Consistency Group can be accomplished by first navigating to the **Consistency Group** tab within the **Block** page. From this page either double click the Name of a Consistency Group, or after selecting a Consistency Group click the Pencil (View/Edit) icon. This will open the Consistency Group Properties window. An example of this window can be seen in Figure 14.

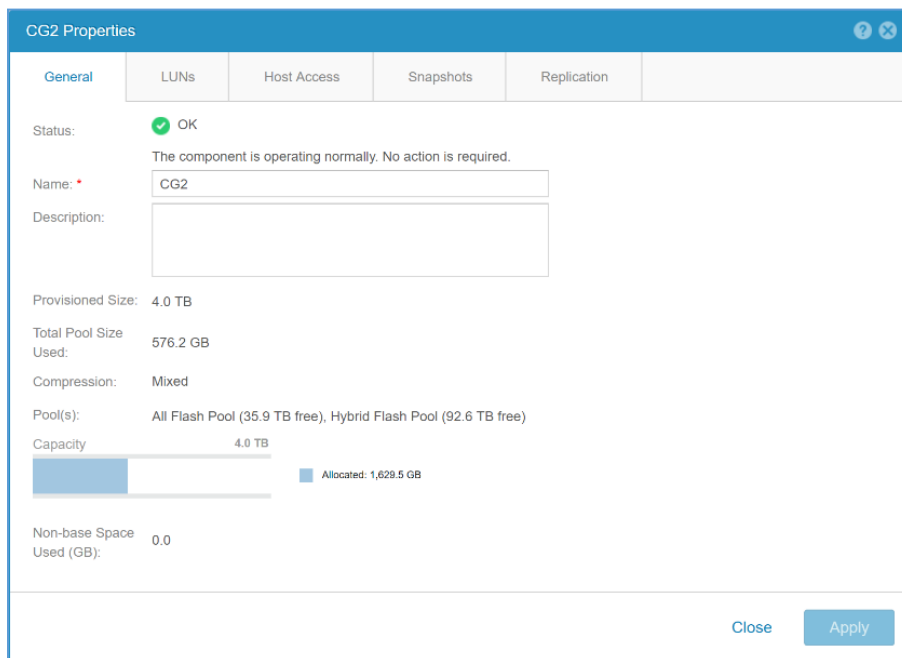


Figure 14. Consistency Group Properties Window

After opening the Consistency Group Properties window, navigate to the LUNs tab. From this screen you can view the current LUNs within the Consistency Group, and the current compression state if the **Compression** column is displayed. A sample of the LUNs tab is shown in Figure 15. To edit the settings of one of the LUNs, double click the LUN or select the LUN and click the **Pencil** icon.

	!	LUN	↑	Size (GB)	Allocated (%)	Snapshot (GB)	Thin	Compression	Pool
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CG2 All Flash LUN-00		1,024.0	<div style="width: 100%;"><div style="width: 100%;"></div></div>	0.0	Yes	Yes	All Flash Pool
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CG2 All Flash LUN-01		1,024.0	<div style="width: 100%;"><div style="width: 100%;"></div></div>	0.0	Yes	Yes	All Flash Pool
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CG2 Hybrid Flash LUN-00		1,024.0	<div style="width: 100%;"><div style="width: 100%;"></div></div>	0.0	Yes	No	Hybrid Flash Pool
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CG2 Hybrid Flash LUN-01		1,024.0	<div style="width: 100%;"><div style="width: 100%;"></div></div>	0.0	Yes	No	Hybrid Flash Pool

Figure 15. Consistency Group – LUNs Tab

The LUN Properties window is now shown. This is the exact same Properties window as a LUN not currently in a Consistency Group. An example of this window is shown in Figure 16. As mentioned previously, to enable or disable compression on a LUN, simply check or uncheck the **Compression** box and click **Apply**. The new state for compression is reflected in the LUNs tab within the Consistency Group Properties window.

CG2 All Flash LUN-00 Properties

General | Host Access | Host I/O Limit

Status:  OK  
The LUN is operating normally. No action is required.

Name:

Description:

Size:

Thin:  Yes

Compression

Capacity:

Allocated:

Pool: All Flash Pool (35.9 TB Free)

Total Pool Space Used: 576.0 GB

Non-base Space Used: 0.0 GB

Compression Savings: 174.0 GB (53% or 2.1:1)

SP Owner:

Close Apply

Figure 16. LUN Properties Window

Unisphere CLI can also be used to enable and disable compression on an existing LUN contained within a Consistency Group. The command to make this change is the `/stor/prov/luns/lun set` command, as discussed previously in the LUNs section under **Enabling and Disabling Compression on an Existing Storage Resource**. Please review that section for more information on how to enable or disable compression on a Consistency Group LUN.

## FILE SYSTEMS

Compression can be enabled or disabled at any time on File Systems created on Dell EMC Unity OE version 4.2 or later if they reside within an All Flash Pool. To do this, first navigate to the **File** page by selecting **File** under **Storage** in the left Unisphere pane. In this window, all existing File Systems on the system are displayed. To enable or disable compression on a File System, double click on a supported File System to modify it, or select a File System and select the Pencil icon. The Properties window is now shown. To enable or disable compression, simply check or uncheck the Compression box and click Apply. A sample of the Properties window for a compression enabled File System is shown in Figure 17. The File System currently has Compression disabled, and the Compression

box has been selected to enable compression on the resource, but Apply has not yet been selected. When enabling compression on a resource, an informational message is displayed after checking the **Compression** box. The message states:

*Only the newly written data will be compressed. Existing data will remain uncompressed.*

This message outlines that only new writes to the File System or overwrites to existing data within the File System are considered for compression.

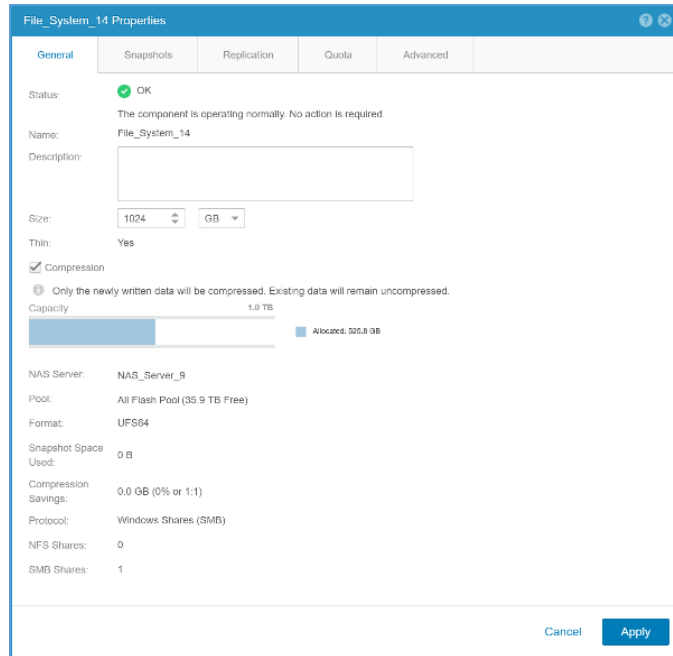


Figure 17. File System Properties Window – Enabling Compression

When reviewing the Properties window for a File System which does not support compression, no option to enable compression will be shown. This is true for Thick File Systems, and any File Systems created previous to upgrading to Dell EMC Unity OE version 4.2. Figure 18 below shows an example of the File System Properties window for a File System created previous to Dell EMC Unity OE version 4.2. As you can see, even though the File System is Thin, no option for compression is shown.

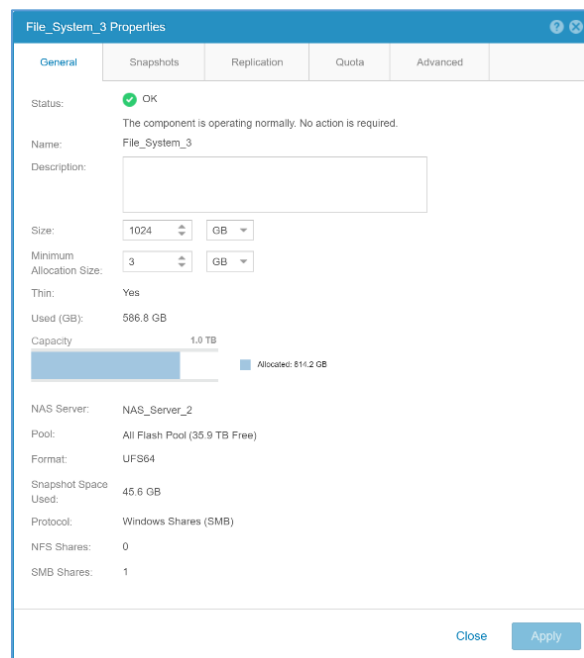
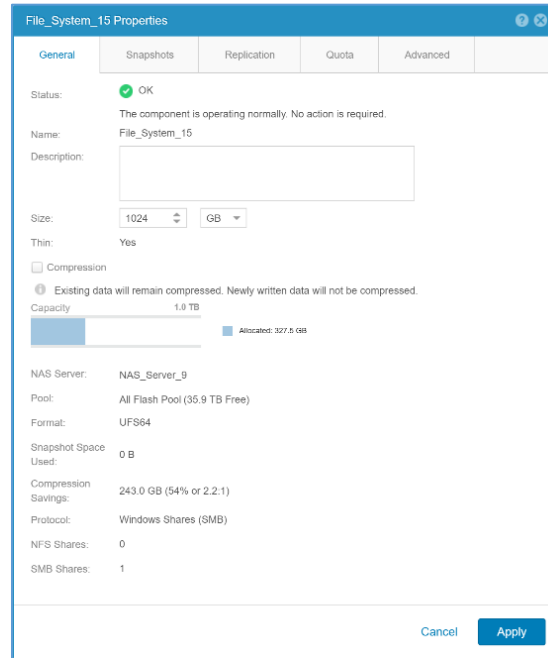


Figure 18. File System Properties Window – Compression Not Supported

Figure 19 below shows the Properties window of a File System which currently has Compression enabled. The Compression box has been deselected to disable compression on the resource, but Apply has not yet been selected. When disabling compression on a resource, an informational message is displayed after unchecking the Compression box. The message states:

*Existing data will remain compressed. Newly written data will not be compressed.*

This message implies that only overwrites to the File System will cause compression savings to decrease.



**Figure 19. File System Properties Window – Disabling Compression**

Enabling or disabling compression on a File System which supports compression can also be achieved using Unisphere CLI. The **-compression** option has been added to the `/stor/prov/fs set` command. If a File System that does not support compression is sent a command to enable or disable compression, an error is provided. Below is the usage of the `/stor/prov/fs set` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/fs -help

File system
Actions:

[Set]
/stor/prov/fs -id <value> set [ -async ] [ -descr <value> ] [ -accessPolicy { native | Unix | Windows } ] [ -folderRenamePolicy { allowedAll | forbiddenSmb | forbiddenAll } ] [ -lockingPolicy { advisory | mandatory } ] [ -size <value> ] [ -minSizeAllocated <value> ] [ -compression { yes | no } ] [ -cifsSyncWrites { yes | no } ] [ -fastvpPolicy { startHighThenAuto | auto | highest | lowest } ] [ -cifsOpLocks { yes | no } ] [ -cifsNotifyOnWrite { yes | no } ] [ -cifsNotifyOnAccess { yes | no } ] [ -cifsNotifyDirDepth <value> ] [ { -sched <value> | -noSched } ] [ -schedPaused { yes | no } ] [ -replDest { yes | no } ] [ -poolFullPolicy { deleteAllSnaps | failWrites } ] [ -eventProtocols <value> ]
```

Below is an example of enabling compression on an existing File System named *File\_System\_13*, which has a CLI ID of *res\_41*, using Unisphere CLI. Disabling compression is just as easy, and can be accomplished by simply swapping `-compression yes` for `-compression no`.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/fs -id res_41 set -compression yes

ID = res_41
Operation completed successfully.
```

## VMWARE VMFS AND NFS DATASTORES

Enabling or disabling compression on existing VMware VMFS or NFS Datastores which support compression can be accomplished at any time through Unisphere, Unisphere CLI, or REST API. To enable or disable compression in Unisphere, first navigate to the **VMware** page within Unisphere. To do so, select **VMware** under **Storage** in the left Unisphere pane. All existing VMware Datastores are displayed on this page. To enable or disable compression on a VMware Datastore which supports compression, double click on a Datastore to modify it, or select the Datastore and select the Pencil icon. The Properties window is now shown. To enable or disable compression, simply check or uncheck the **Compression** box and click **Apply**. A sample of the Properties window for a VMware VMFS Datastore is shown in Figure 20.

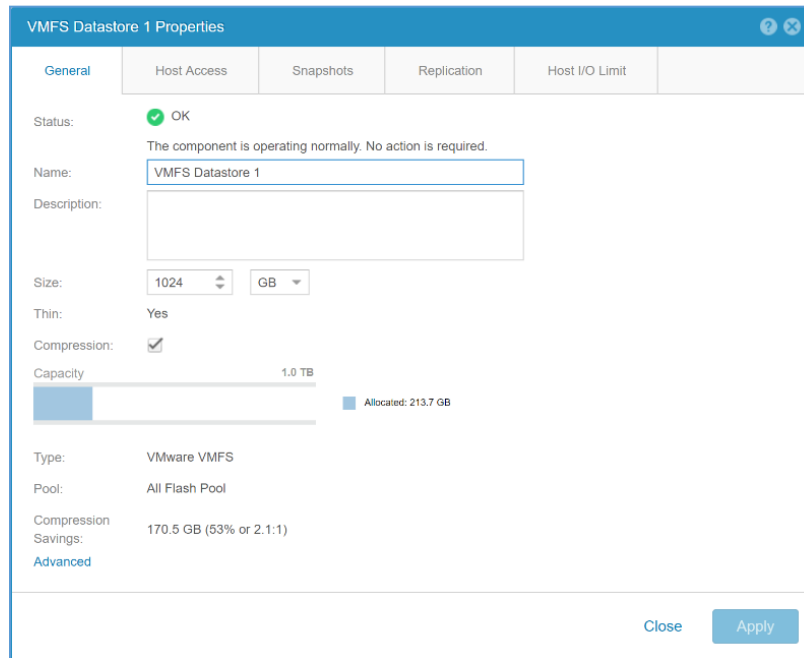


Figure 20. VMware VMFS Datastore – Properties Window

For VMware NFS Datastores, compression is only supported if the resource is Thin, resides on an All Flash Pool, and is created while the system is running Dell EMC Unity OE version 4.2 or later. If the resource supports compression, compression can be enabled or disabled at any time. If the resource is Thick, or was created on an earlier code, Unisphere will not display an option to enable compression. When attempting to enable or disable compression on a resource which does not support compression via Unisphere CLI or REST API, an error will be returned.

Enabling or disabling compression on a VMware VMFS Datastore can be achieved using Unisphere CLI. The **-compression** option has been added to the `/stor/prov/vmware/vmfs set` command. Below is the usage of the `/stor/prov/vmware/vmfs set` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/vmfs -help
```

```
VMware VMFS Datastore  
Actions:
```

```
[Set]  
/stor/prov/vmware/vmfs -id <value> set [ -async ] [ -name <value> ] [ -descr <value> ] [ -size  
<value> ] [ { -sched <value> | -noSched } ] [ -schedPaused { yes | no } ] [ -spOwner { spa | spb } ]  
[ -replDest { yes | no } ] [ -compression { yes | no } ] [ -fastvpPolicy { startHighThenAuto |  
auto | highest | lowest } ] [ -vdiskHosts <value> ] [ -snapHosts <value> ] [ { -ioLimit <value> |  
-noIoLimit } ]
```

Below is an example of enabling compression on an existing VMFS Datastore named `VMFS_Datastore`, which has a CLI ID of `res_1`, using Unisphere CLI. Disabling compression is just as easy, and can be accomplished by simply swapping `-compression yes` for `-compression no`.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/vmfs -id res_1 set -compression yes
```

```
ID = res_1
Operation completed successfully.
```

Likewise, enabling or disabling compression on a VMware NFS Datastore can also be achieved using Unisphere CLI. The **-compression** option has been added to the `/stor/prov/vmware/nfs set` command. Below is the usage of the `/stor/prov/vmware/nfs set` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/nfs -help
```

Manage VMware Network Filesystem Share (NFS) datastores. NFS datastores provide file storage to ESX Server hosts through the NFS protocol.

Actions:

```
[Set]
/stor/prov/vmware/nfs -id <value> set [ -async ] [ -descr <value> ] [ -size <value> ] [
-minSizeAllocated <value> ] [ -compression { yes | no } ] [ { -sched <value> | -noSched } ] [
-schedPaused { yes | no } ] { [ -defAccess { ro | rw | root | na } ] | [ -roHosts <value> ] [
-rwHosts <value> ] [ -rootHosts <value> ] [ -naHosts <value> ] } [ -esxMountProtocol { NFSv3 |
NFSv4 } ] [ -minSecurity { sys | krb5 } ] [ -replDest { yes | no } ] [ -eventProtocols <value> ]
[ -fastvpPolicy { startHighThenAuto | auto | highest | lowest } ] [ -poolFullPolicy {
deleteAllSnaps | failWrites } ]
```

Below is an example of enabling compression on an existing NFS Datastore named *NFS\_Datastore*, which has a CLI ID of *res\_40*, using Unisphere CLI. This resource was created on Dell EMC Unity OE version 4.2, which added compression support for newly created VMware NFS Datastores on this code. Disabling compression is just as easy, and can be accomplished by simply swapping `-compression yes` for `-compression no`.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/nfs -id res_40 set -compression yes
```

```
ID = res_40
Operation completed successfully.
```

## HOW TO DETERMINE WHICH STORAGE RESOURCES HAVE COMPRESSION ENABLED

Dell EMC Unity Compression is supported on Thin LUNs, whether standalone or within a Consistency Group, Thin File Systems, and Thin VMware VMFS and NFS Datastores. The following sections outline how you can easily determine what the current state of compression is on existing resources using Unisphere and Unisphere CLI.

### LUNS

To review the status of compression on each of the LUNs created on the system, navigate to the **Block** page, which can be accessed by selecting **Block** under **Storage** in the left Unisphere pane. This page has been updated with two new columns specific for compression. The new columns added are a **Compression** column, which shows if compression is enabled or not on the resource, and the **Compression Savings (GB)** column, which shows the amount of savings in GBs for the resource. To add these and other columns to the view, simply click the **Gear** Icon in the top right portion of the LUNs tab and select the new columns to add under the **Columns** option. An example of this screen is shown in Figure 21.

Compression information has also been added to the quick properties view of the **LUN** Tab on the **Block** page. After selecting a LUN, the right portion of the screen is populated with more information about the storage resource. In Figure 21, a compression enabled storage resource is selected. In the information provided in the right portion of the screen, you can determine if **Compression** is enabled and the current **Compression Savings** on the selected resource. This is an easy way to review the current state of compression on a specific resource if the **Compression** and **Compression Savings (GB)** columns are not shown.

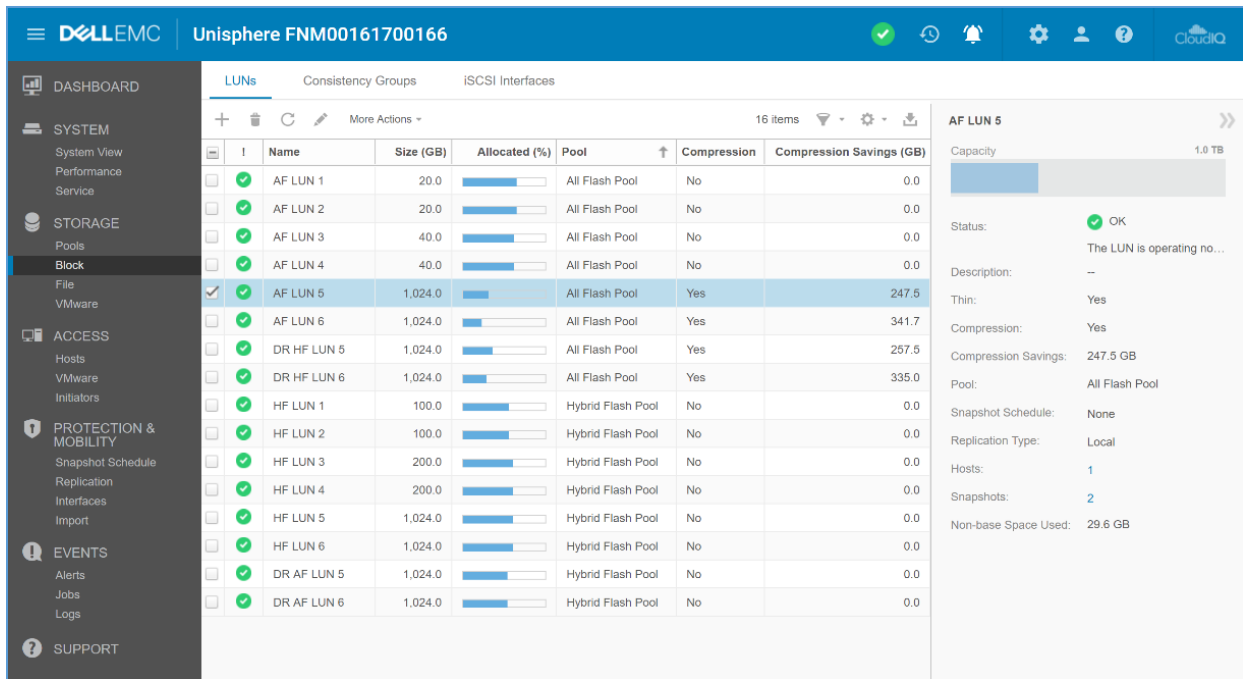


Figure 21. Block Page – LUNs Tab

Reviewing which LUNs have compression enabled can also be completed using Unisphere CLI by using the `/stor/prov/luns/lun show` command. This command allows you to display brief or detailed information about each LUN. Below is an example of the syntax of the `/stor/prov/luns/lun show` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun -help
```

```
LUN
Actions:
[Show]
/stor/prov/luns/lun [ { -id <value> | -group <value> | -standalone } ] show [ -output { nvp | csv |
table [ -wrap ] } ] [ { -brief | -detail | -filter <value> } ]
```

Below is an example where the filter option is used. By using the filter option, we can narrow down the information returned by the system to a specific set of items. In this example, we display only the LUN Name, and if Compression is enabled. A sample run of the command is shown below.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun show -filter Name,"Compression
enabled"
```

```
9: Name = AF LUN 5
Compression enabled = yes

10: Name = AF LUN 6
Compression enabled = yes

11: Name = HF LUN 5
Compression enabled = no

12: Name = HF LUN 6
Compression enabled = no
```

### CONSISTENCY GROUP LUNS

To review which Consistency Groups contain compression enabled LUNs, view the **Consistency Group** tab, which is found on the **Block** page. On this page, a new column named **Compression** is added on Dell EMC Unity OE versions which support compression. This column can be added to the current view by clicking the **Gear Icon** and selecting **Compression** under **Column**. An example of the



Consistency Group tab with the Compression column displayed is shown in Figure 22. The **Compression** tab has three potential entries, **No**, **Yes**, and **Mixed**. **No** is displayed if none of the LUNs within the Consistency Group have compression enabled. **Yes** is displayed if all LUNs within the Consistency Group have compression enabled. **Mixed** is displayed if there are a mix of compression enabled and disabled LUNs within the Consistency Group. After selecting a Consistency Group, the quick properties view also displays the **Compression** option, and **No**, **Yes**, or **Mixed**.

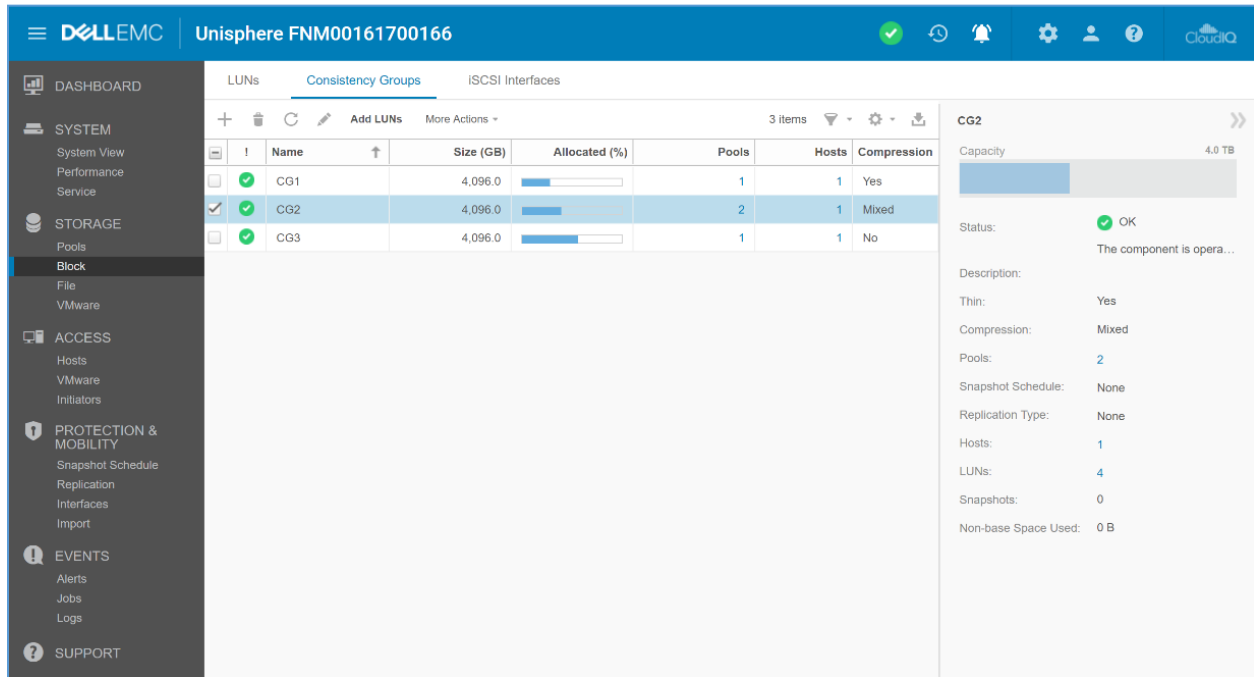


Figure 22. Block Page – Consistency Group Tab

LUNs within a Consistency Group are also reported in the `/stor/prov/luns/lun show` Unisphere CLI command. When reviewing the full details of a LUN, the `Group` entry is the Consistency Group the LUN is part of. Below is a sample of the `/stor/prov/luns/lun show` command filtered by Name, Group, and Compression Enabled.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun show -filter Name,Group,"Compression enabled"
```

```
21: Name           = CG2 All Flash LUN-00
    Group          = res_40
    Compression enabled = yes
```

```
22: Name           = CG2 All Flash LUN-01
    Group          = res_40
    Compression enabled = yes
```

```
23: Name           = CG2 Hybrid Flash LUN-00
    Group          = res_40
    Compression enabled = no
```

```
24: Name           = CG2 Hybrid Flash LUN-01
    Group          = res_40
    Compression enabled = no
```

In the output above, the 4 LUNs displayed in the sample output are from the Consistency Group with the internal Group ID of **res\_40**. To determine which Consistency Group on the system this is, the `/stor/prov/luns/group show` command can be used. A sample of this command is displayed below.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/group -id res_40 show
```

```
1: ID           = res_40
```

```

Name = CG2
Description =
Type = Primary
Health state = OK (5)
Total capacity = 4398046511104 (4.0T)
Total protection size used = 0
Total non-base size used = 0

```

## FILE SYSTEMS

To review the status of compression on each of the File Systems, navigate to **File Systems** tab within the **File** page, which can be accessed by selecting **File** under **Storage** in the left Unisphere pane. This page has been updated in Dell EMC Unity OE version 4.2 with two new columns specific for compression. The new columns added are a **Compression** column, which shows if compression is enabled or not on the resource, and the **Compression Savings (GB)** column, which shows the amount of savings in GBs for the resource. To add these and other columns to the view, simply click the **Gear** icon in the top right portion of the File Systems tab and select the new columns to add under the **Columns** option. An example of this screen is shown in Figure 23.

When reviewing the **Compression** and **Compression Savings (GB)** columns, the information provided depends on if the storage resource supports compression or not. For Thick File Systems or File Systems created on a code prior to Dell EMC Unity OE version 4.2, -- is displayed in the in the columns to denote that the storage resource does not support compression. For Thin File Systems created on Dell EMC Unity OE version 4.2 or later, the **Compression** column will display **Yes** or **No** depending on if compression is enabled or not. **No** is also displayed for File Systems created on Dell EMC Unity OE version 4.2 or later, and currently reside within a non-All Flash Pool. The **Compression Savings (GB)** column displays the amount of savings currently achieved within the File System. As compression savings are not removed when disabling compression on a storage resource, compression may be disabled, but savings still exist.

Compression information has also been added to the quick properties view of the **File Systems** tab on the **File** page. After selecting a File System, the right portion of the screen is populated with more information about the storage resource. In Figure 23Figure 21, a compression enabled storage resource is selected. In the information provided in the right portion of the screen, you can determine if **Compression** is enabled and the current **Compression Savings** on the selected resource. This is an easy way to review the current state of compression on a specific resource if the **Compression** and **Compression Savings (GB)** columns are not shown. The -- designation, which is explained above, is also used when the storage resource selected does not support compression.

The screenshot shows the Dell EMC Unisphere interface for File Systems. The main table lists 28 file systems with columns for Name, Size (GB), Used (%), Pool, Compression, and Compression Savings (GB). File\_System\_15 is selected, and its detailed properties are shown on the right.

Name	Size (GB)	Used (%)	Pool	Compression	Compression Savings (GB)
File_System_18	1,024.0		All Flash Pool	Yes	203.2
File_System_17	1,024.0		All Flash Pool	No	0.0
File_System_16	1,024.0		All Flash Pool	--	--
File_System_15	1,024.0		All Flash Pool	Yes	243.0
File_System_14	1,024.0		All Flash Pool	No	0.0
File_System_13	1,024.0		All Flash Pool	--	--
File_System_12	1,024.0		Hybrid Flash Pool	--	--
File_System_11	1,024.0		Hybrid Flash Pool	--	--
File_System_10	1,024.0		Hybrid Flash Pool	--	--
File_System_9	1,024.0		Hybrid Flash Pool	--	--
File_System_8	1,024.0		Hybrid Flash Pool	--	--
File_System_7	1,024.0		Hybrid Flash Pool	--	--
File_System_6	1,024.0		All Flash Pool	--	--
File_System_5	1,024.0		All Flash Pool	--	--
File_System_4	1,024.0		All Flash Pool	--	--
File_System_3	1,024.0		All Flash Pool	--	--
File_System_2	200.0		All Flash Pool	--	--
File_System_1	200.0		All Flash Pool	--	--

**FILE\_SYSTEM\_15** Properties:

- Capacity: 1.0 TB
- Status: OK
- Description: The compon...
- Thin: Yes
- Compression: Yes
- Compression Savings: 243.0 GB
- Pool: All Flash Pool
- NAS Server: NAS\_Server\_9
- Protocol: Windows Shares (SMB)
- NFS Shares: 0
- SMB Shares: 1
- Snapshot Schedule: None
- Replication Type: None
- Snapshots: 0
- Snapshot Space Used: 0 B

Figure 23. File Page – File Systems Tab

Reviewing which File Systems have compression enabled can also be completed using Unisphere CLI by using the `/stor/prov/fs show` command. This command allows you to display brief or detailed information about each File System. Below is an example of the syntax of the `/stor/prov/fs show` command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/fs -help

File system
Actions:
[Show]
/stor/prov/fs [ -id <value> ] show [ -output { nvp | csv | table [ -wrap ] } ] [ { -brief | -detail
| -filter <value> } ]
```

Below is an example where the filter option is used. By using the filter option, we can narrow down the information returned by the system to a specific set of items. In this example, we display only the File System Name, and if compression is enabled. A sample run of the command is shown below. Blank entries are returned for File Systems which do not support compression.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/fs show -filter Name,"Compression enabled"

24:  Name                = File_System_14
     Compression enabled = no

25:  Name                = File_System_15
     Compression enabled = yes

26:  Name                = File_System_16
     Compression enabled =

27:  Name                = File_System_17
     Compression enabled = no

28:  Name                = File_System_18
     Compression enabled = yes
```

## VMWARE VMFS AND NFS DATASTORES

To review the status of compression on each of the VMware VMFS and NFS Datastores created on the system, navigate to the **VMware** page, which can be accessed by selecting **VMware** under **Storage** in the left Unisphere pane. This page has been updated with two new columns specific for compression. The new columns added are a **Compression** column, which shows if compression is enabled or not on the resource, and the **Compression Savings (GB)** column, which shows the amount of savings in GBs for the resource. To add these and other columns to the view, simply click the **Gear** Icon in the top right portion of the Datastores tab and select the new columns to add under the Columns option. An example of this screen is shown in Figure 24.

When reviewing the **Compression** and **Compression Savings (GB)** columns, the information provided depends on if the storage resource supports compression or not. For Thick NFS Datastores or NFS Datastores created on a code prior to Dell EMC Unity OE version 4.2, -- is displayed in the in the columns to denote that the storage resource does not support compression. For Datastores which support compression, the **Compression** column will display **Yes** or **No** depending on if compression is enabled or not. **No** is also displayed for Datastores which support compression, but currently reside within a non-All Flash Pool. The **Compression Savings (GB)** column displays the amount of savings currently achieved within the File System. As compression savings are not removed when disabling compression on a storage resource, compression may be disabled, but savings still exist.

Compression information is also added to the quick properties view of the **Datastores** Tab on the **VMware** page. After selecting a VMware Datastore, the right portion of the screen is populated with more information about the storage resource. In Figure 24, a compression enabled storage resource has been selected. In the information provided in the right portion of the screen, you can determine if **Compression** is enabled, and the current **Compression Savings** on the selected resource. This is an easy way to review the current state of compression on a specific resource if the **Compression** and **Compression Savings (GB)** columns are not shown. The -- designation, which is explained above, is also used when the storage resource selected does not support compression.

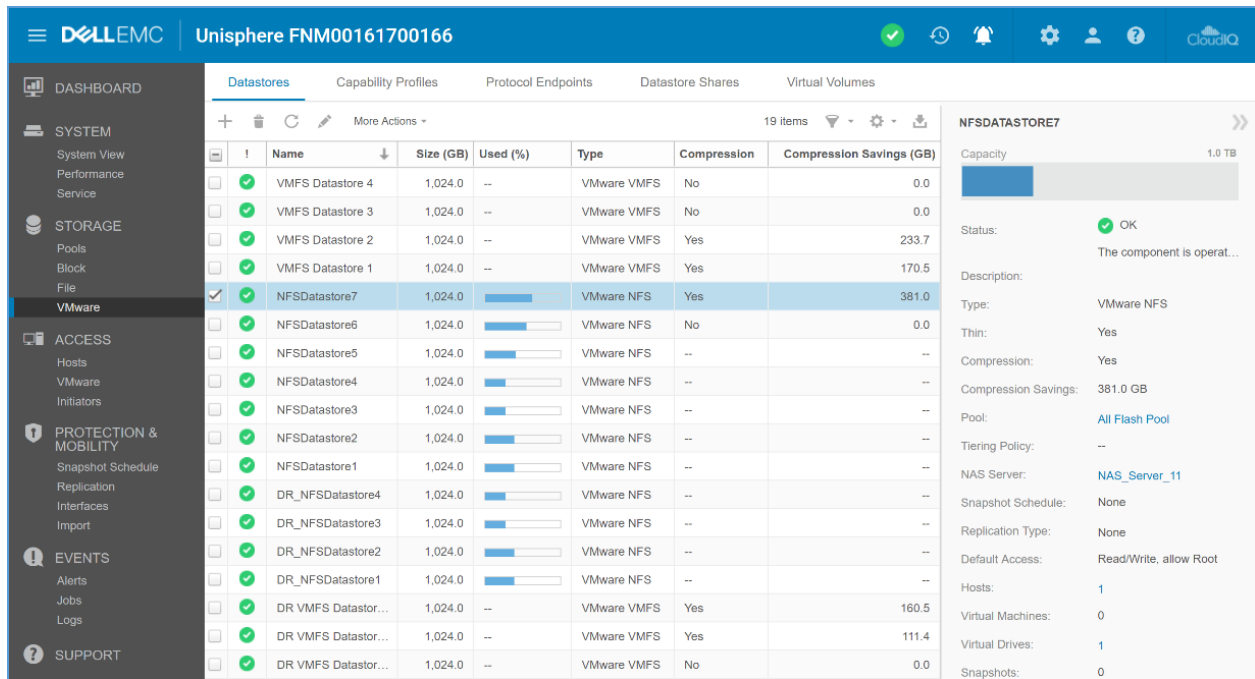


Figure 24. VMware Page – Datastores Tab

From Unisphere CLI you can also determine if Compression is enabled on a VMware Datastore. This information can be retrieved using the `/stor/prov/vmware/vmfs show` or `/stor/prov/vmware/nfs show` command, depending on which type of Datastore you wish to review. Below is an example of the syntax of the `/stor/prov/vmware/vmfs show` command. The `/stor/prov/vmware/nfs show` command and its usage are similar.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/vmfs -help
```

VMware VMFS datastore

Actions:

[Show]

```
/stor/prov/vmware/vmfs [ -id <value> ] show [ -output { nvp | csv | table [ -wrap ] } ] [ { -brief | -detail | -filter <value> } ]
```

Below is a sample of the `/stor/prov/vmware/vmfs show` command filtered by ID, Name, and Compression enabled.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/vmfs show -filter ID,Name,"Compression enabled"
```

```
2: ID = res_4
   Name = VMFS Datastore 2
   Compression enabled = yes
```

```
3: ID = res_5
   Name = VMFS Datastore 3
   Compression enabled = no
```

## COMPRESS NOW

The Compress Now option is used to move a Block storage resource's dataset to a compression enabled storage resource within the same Pool. The Compress Now option leverages the system's Local LUN Move operation to complete the operation. Compress Now is mainly used to compress existing data on a Block storage resource which recently had compression enabled on it, but Compress Now can be utilized at any time. The Compress Now option is not supported on Dell EMC Unity models 350F, 450F, 550F, and 650F.

The Compress Now option can be found on the **Block** page for LUNs. After selecting a compression enabled resource, select the **More Actions** drop down list, then **Compress Now**. This launches the **Compress Now** dialog box. An example of the **More Actions** dialog box and the **Compress Now** option can be found in Figure 25.

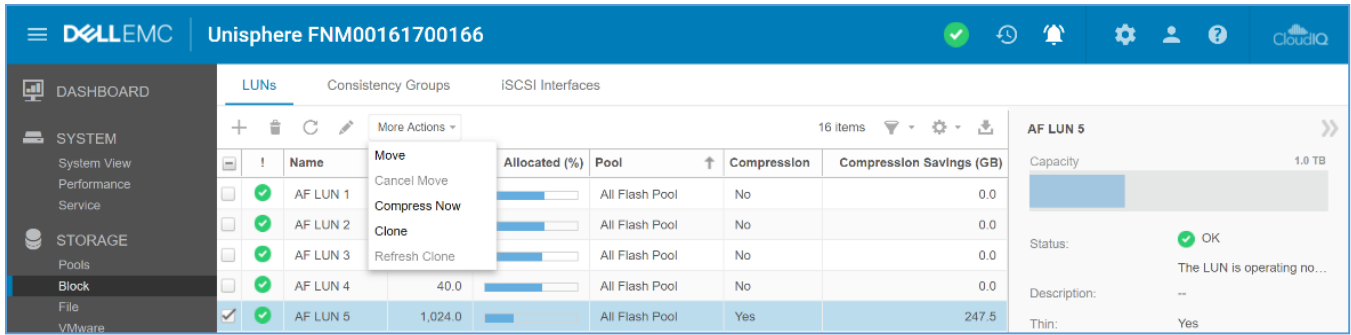


Figure 25. Block Page – Compress Now Under More Actions

The Compress Now dialog box is shown in Figure 26 below. As the box mentions, the data is automatically moved within the same Pool. As data is moved within the Pool, the data is compressed. This operation is completely transparent to the host. To start the Compress Now operation, simply select **Yes** in the Compress Now dialog box.

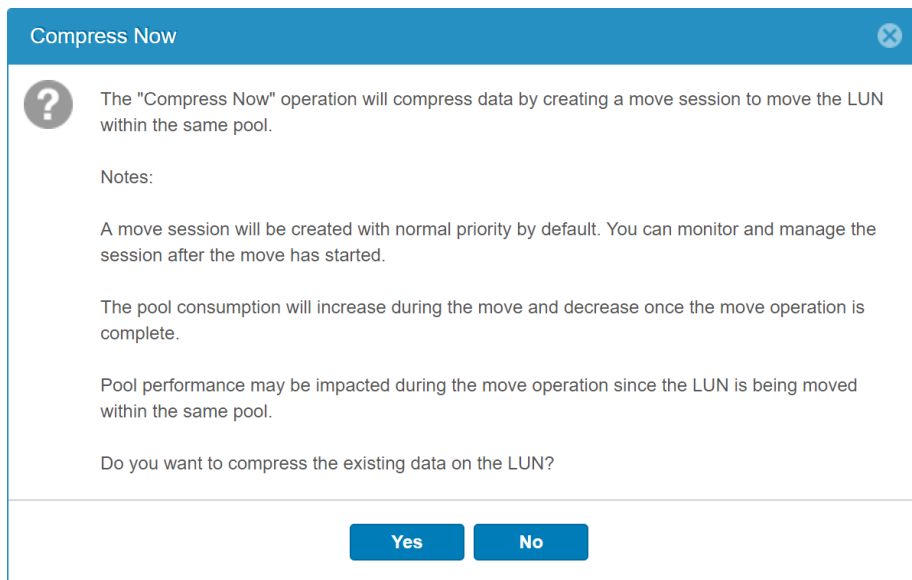


Figure 26. Compress Now dialog box

Compress Now can also be used for LUNs contained within a Consistency Group. The Compress Now option for Consistency Groups is found on the LUNs tab within the Properties window of a Consistency Group. An example of this is shown in Figure 27. After selecting a compression enabled LUN within the Consistency Group, select **More Actions**, then **Compress Now**. A similar dialog box as previously shown in Figure 26 is displayed. After selecting **Yes**, the data is moved.

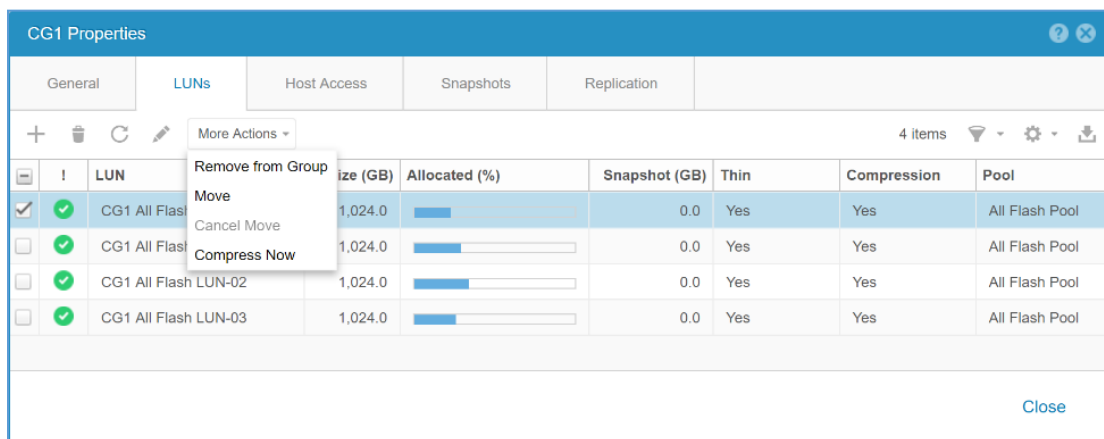


Figure 27. Compress Now – Consistency Group Properties Window – LUN Tab

Compress Now can also be used with VMware VMFS Datastores. For VMware VMFS Datastores, the Compress Now option is found on the **Datastores** tab of the **VMware** page. As shown in Figure 28, after selecting a VMware VMFS Datastore, the **Compress Now** option can be found under **More Actions**. After selecting Compress Now, a dialog box similar to Figure 26 is displayed.

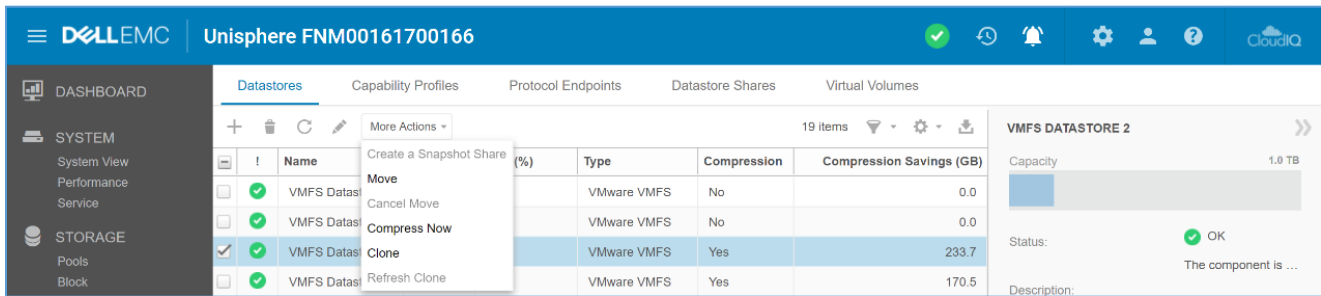


Figure 28. Compress Now – VMware VMFS Datastores

To utilize the Compress Now functionality for storage resources through Unisphere CLI, you must use the `/move/session create` command. This command is used to start a Local LUN Move operation on all types of storage resources, such as standalone LUNs, LUNs in a Consistency Group, and VMware VMFS Datastores. Below is an example of the syntax of the `/move/session create` command.

```
uemcli -d x.x.x.x -u username -p password /move/session -help
```

Manage move sessions.

Actions:

[create]

```
/move/session create -srcRes <value> [ -srcMemberLun <value> ] -targetPool <value> [ -priority { idle | low | below | normal | above | high } ] [ -thin { yes | no } ] [ -compressed { yes | no } ] [ -async ]
```

Below is a sample of the `/move/session create` command which moves a standalone LUN within the same Pool. The source LUN, which is named *All Flash LUN-05* and has a CLI ID of `sv_78`, is moved within the All Flash Pool, which has a CLI ID of `pool_1`. The destination storage resource of the Local LUN Move operation is Thin, and compression enabled.

```
uemcli -d x.x.x.x -u username -p password /move/session create -srcRes sv_78 -targetPool pool_1 -thin yes -compressed yes
```

ID=move\_4

Operation completed successfully.

For LUNs contained in Consistency Groups, the Consistency Group information must also be specified in the Move command. The sample command below starts a Local LUN Move operation on a LUN named *CG1 LUNs-00*, with a CLI ID of `sv_62`, within the All Flash Pool. The Consistency Group that the LUN is contained in is named *CG1*, and has a CLI ID of `res_12`. The destination storage resource of the Local LUN Move operation is Thin and compression enabled.

```
uemcli -d x.x.x.x -u username -p password /move/session create -srcRes res_12 -srcMemberLun sv_62 -targetPool pool_1 -thin yes -compressed yes
```

ID=move\_5

Operation completed successfully.

Starting a Local LUN Move operation on a VMware VMFS Datastore is similar to starting a Local LUN Move operation on a LUN. The command below moves data for a VMware VMFS Datastore named *VMFS\_Datastore1*, with a CLI ID of `res_15`, within the All Flash Pool. The destination storage resource of the Local LUN Move operation is Thin, and compression is enabled.

```
uemcli -d x.x.x.x -u username -p password /move/session create -srcRes res_15 -targetPool pool_1 -thin yes -compressed yes
```

ID=move\_6

Operation completed successfully.

## SAVINGS REPORTING

Dell EMC Unity Compression provides savings information at many different levels within the system, and in many different formats. Savings information is provided at the individual storage resource, the Pool, and the System level. For each of the levels, savings information is reported in GBs, percent savings, and a compression ratio. The total GBs saved not only includes savings due to compression on the storage resource, but also savings which are realized on any Snapshots and Thin Clones taken of the resource. The percentage saved and the ratio reflect the compressibility of the storage resource itself. All savings information is aggregated and then displayed at the Pool level and System level. The following sections outline where savings information can be viewed in Unisphere, along with how to access savings information through Unisphere CLI. Savings information is also accessible via REST API, but won't be covered in the following sections.

### STORAGE RESOURCE LEVEL

Space savings information in the three formats are available within the Properties window of the storage resource. For LUNs, you will either need to access the Properties page from the **Block** page, or on the **LUN** tab from within the **Consistency Group** Properties window. As shown in Figure 29, Compression Savings are shown on the **General** tab within the LUN Properties Window. Shown is the total GBs saved, which includes savings within data utilized by Snapshots and Thin Clones of the storage resource. Also shown is the % saved and the compression ratio, which both reflect the compression savings within the storage resource.

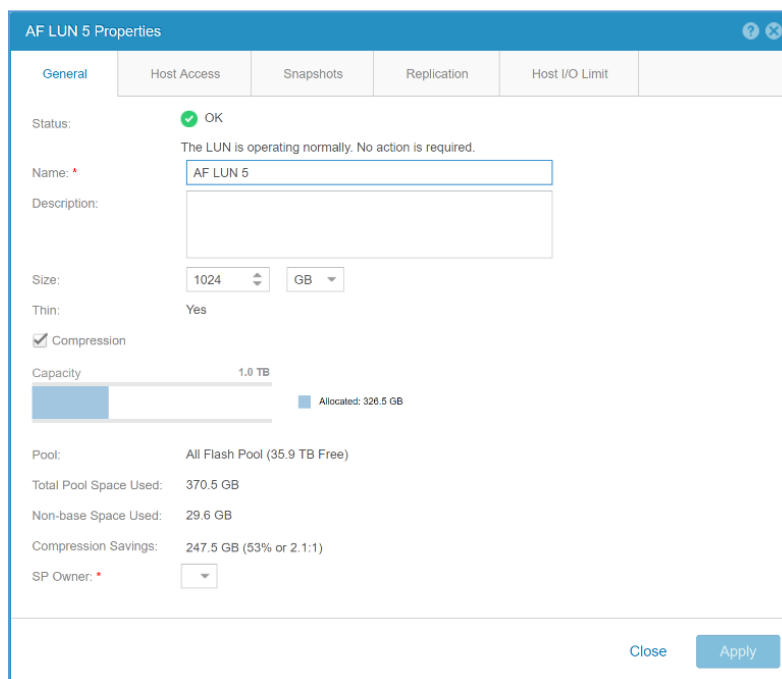


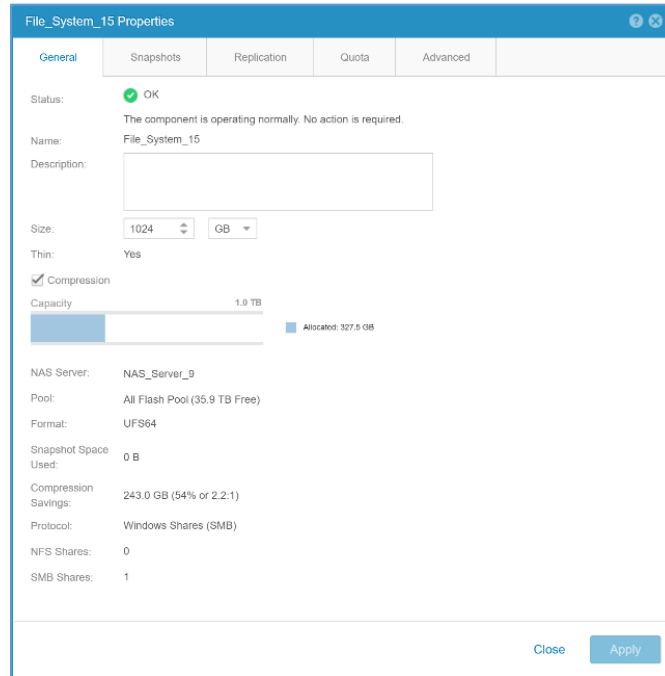
Figure 29. LUN Properties Window - Compression Savings

Savings information can also be retrieved through Unisphere CLI by using the `/stor/prov/luns/lun show` command. This command allows you to display brief or detailed information about each LUN. Below is an example of the syntax of the `/stor/prov/luns/lun show` command and an output containing compression specific information for a LUN. The output below is just a portion of the information returned by the command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/luns/lun -id sv_52 show -detail
```

```
1: ID = sv_9
   Name = AF LUN 5
   Size = 1099511627776 (1.0T)
   Maximum size = 281474976710656 (256.0T)
   Compression enabled = yes
   Compression space saved = 265751101440 (247.5G)
   Compression percent = 53%
   Compression ratio = 2.1:1
```

File Systems also provide the same compression savings information as LUNs. Figure 30 below shows an example of the Properties window of a File System. As with LUNs, the Compression Savings are reported in GBs, % savings, and compression ratio.



**Figure 30. File System Properties Window – Compression Savings**

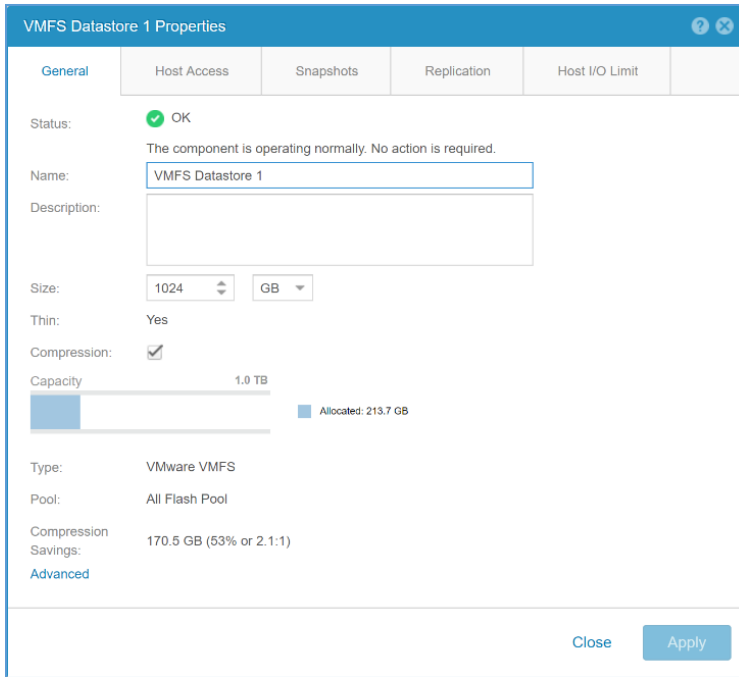
Savings information can also be reviewed using Unisphere CLI and REST API. For Unisphere CLI, File System savings information can be found by using the `/stor/prov/fs show` command. This command allows you to display brief or detailed information about each File System. Below is an example of the syntax of the `/stor/prov/fs show` command and an output containing compression specific information for a File System. The output below is just a portion of the information returned by the command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/fs -id res_42 show -detail
```

```
1: ID = res_44
   Name = File_System_15
   Storage pool = All Flash Pool
   Size = 1099511627776 (1.0T)
   Size used = 613715918848 (571.5G)
   Maximum size = 281474976710656 (256.0T)
   Thin provisioning enabled = yes
   Compression enabled = yes
   Compression space saved = 260919263232 (243.0G)
   Compression percent = 54%
   Compression ratio = 2.2:1
```

VMware VMFS Datastores display compression savings in the same manner as LUNs and File Systems. In the VMware VMFS Properties window on the General tab, the GBs saved, % savings, and compression ratio can be viewed. An example of this screen can be found in Figure 31.





**Figure 31. VMware VMFS Datastore Properties Window – Compression Savings**

Savings information can also be retrieved through Unisphere CLI for VMware VMFS Datastores by using the `/stor/prov/vmware/vmfs show` command. This command allows you to display brief or detailed information about each VMFS Datastore. Below is an example of the syntax of the `/stor/prov/vmware/vmfs show` command and an output containing compression specific information for a VMFS Datastore. The output below is just a portion of the information returned by the command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/vmfs -id res_9 show -detail
```

```
1:  ID                = res_3
    Name              = VMFS Datastore 1
    Size              = 1099511627776 (1.0T)
    Maximum size      = 70368744177664 (64.0T)
    Thin provisioning enabled = yes
    Compression enabled = yes
    Compression space saved = 183072980992 (170.5G)
    Compression percent = 53%
    Compression ratio  = 2.1:1
```

VMware NFS Datastores display compression savings in the same manner as VMware VMFS Datastores. In the VMware NFS Properties window on the General tab, the GBs saved, % savings, and compression ratio can be viewed. An example of this screen can be found in Figure 32.

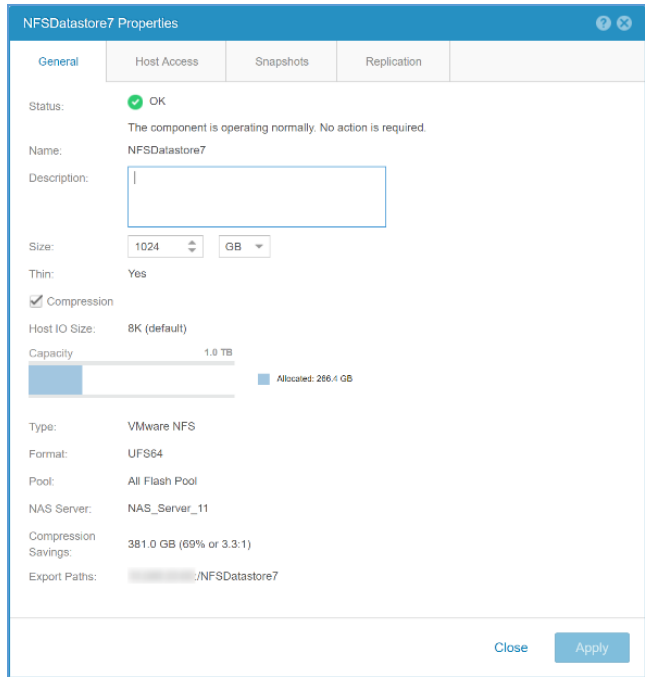


Figure 32. VMware NFS Datastore Properties Window – Compression Savings

Savings information can also be retrieved through Unisphere CLI for VMware NFS Datastores by using the `/stor/prov/vmware/nfs show` command. This command allows you to display brief or detailed information about each NFS Datastore. Below is an example of the syntax of the `/stor/prov/vmware/nfs show` command and an output containing compression specific information for a NFS Datastore. The output below is just a portion of the information returned by the command.

```
uemcli -d x.x.x.x -u username -p password /stor/prov/vmware/nfs -id res_40 show -detail
```

```
1: ID = res_50
   Name = NFSDatastore7
   Server = nas_18
   Size = 1099511627776 (1.0T)
   Size used = 695247912960 (647.5G)
   Maximum size = 281474976710656 (256.0T)
   Host I/O Size = 8K
   Thin provisioning enabled = yes
   Compression enabled = yes
   Compression space saved = 409095634944 (381.0G)
   Compression percent = 69%
   Compression ratio = 3.3:1
```

**POOL LEVEL**

Compression information is also aggregated to the Pool level. Compression savings are reported in the three formats, which include the GBs saved, % savings, and compression ratio, on the **Usage** tab within the **Pool** Properties Window. The GBs savings reflects the total amount of space saved due to compression on storage resources and their Snapshots and Thin Clones. The % saved and the Ratio reflect the average space saved across all compression enabled storage resources. An example of the Usage tab can be seen in Figure 33.

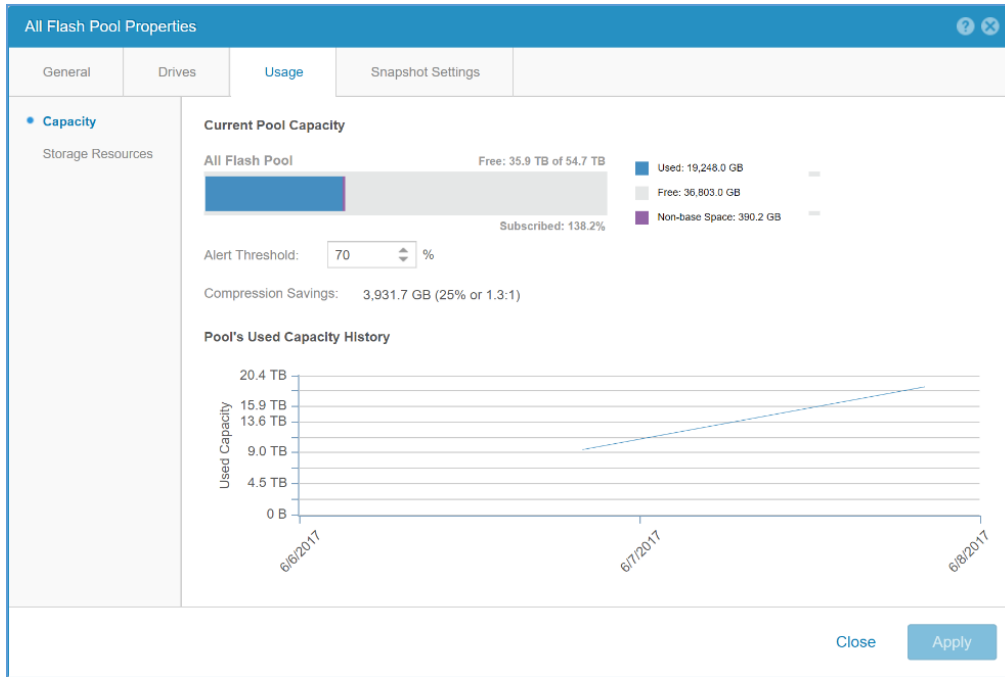


Figure 33. Pool Properties Window – Usage Tab – Compression Savings

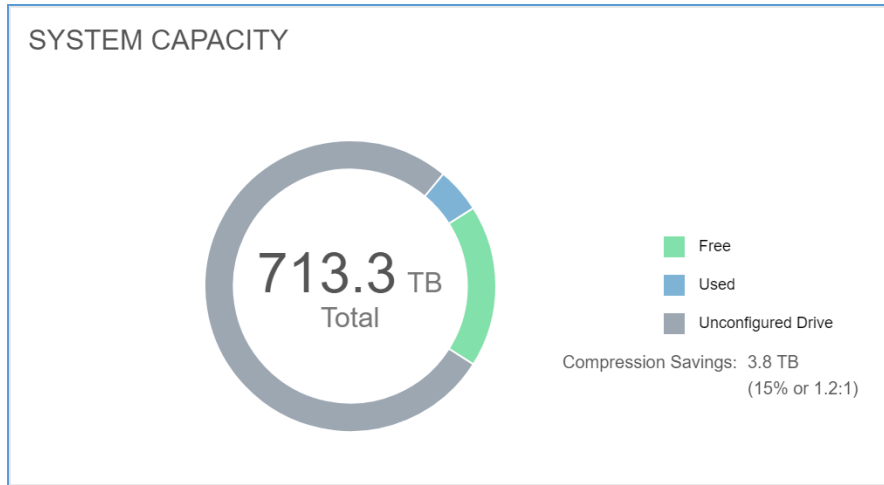
Pool savings information can also be retrieved through Unisphere CLI by using the `/stor/config/pool show` command. This command allows you to display brief or detailed information about each Pool on the system. Below is an example of the syntax of the `/stor/config/pool show` command and an output containing compression specific information for an All Flash Pool. The output below is just a portion of the information returned by the command.

```
uemcli -d x.x.x.x -u username -p password /stor/config/pool show -detail
```

```
1: ID = pool_1
   Name = All Flash Pool
   Total space = 60184302977024 (54.7T)
   Current allocation = 20273050943488 (18.4T)
   Remaining space = 39911252033536 (36.2T)
   Subscription = 83158729195520 (75.6T)
   Compression space saved = 4221684416512 (3.8T)
   Compression Percent = 25%
   Compression Ratio = 1.3:1
```

## SYSTEM LEVEL

Compression savings information is also available at the System Level. The system level aggregates all savings across the entire system and displays them in the three formats available, GBs saved, % saved, and compression ratio. For the GBs saved, this value is the total amount of space saved due to compression, along with savings achieved by Snapshots and Thin Clones of compression enabled storage resources. The % savings and ratio are the average savings achieved across all compression enabled storage resources. The system level savings information is displayed within the System Capacity view block found on the system Dashboard page. If the view block is not shown on your system, you can add it by selecting the **Main** tab, clicking **Customize**, and adding the **System Capacity** view block. An example of the System Capacity view block is shown in Figure 34.



**Figure 34. System Capacity View Block – Unisphere Dashboard Page**

Savings information for the system can also be retrieved through Unisphere CLI by using the `/stor/general/system show` command. This command allows you to display brief or detailed information about the system. Below is an example of the syntax of the `/stor/general/system show` command and an output containing system information.

```
uemcli -d x.x.x.x -u username -p password /stor/general/system show -detail
```

```
1:   Free space           = 141941689810944 (129.0T)
     Used space          = 38607192588288 (35.1T)
     Total space         = 180548882399232 (164.2T)
     Compression space saved = 4221684416512 (3.8T)
     Compression percent   = 15%
     Compression ratio    = 1.2:1
```

## INTEROPERABILITY

Dell EMC Unity Compression is supported on standalone LUNs, LUNs contained within a Consistency Group, File Systems, or VMware VMFS and NFS Datastores. All software features on a storage system are also supported with compression. The following sections talk specifically about certain features of the Dell EMC Unity storage system, and how they relate to Compression.

## DATA AT REST ENCRYPTION

Data at Rest Encryption is fully supported on systems utilizing Dell EMC Unity Compression. Compression is not impacted by Data at Rest Encryption, as all compression operations occur on data residing in System Cache. For data being written to disk, the data is first compressed within System Cache, then written through hardware-based encryption modules to the backend drives. For reads from disk, the data is first decrypted and saved into System Cache before being uncompressed and sent to the host.

More information on Data at Rest Encryption can be found in the *Dell EMC Unity: Data at Rest Encryption* white paper found on Dell EMC Online Support.

## REPLICATION

Storage Resources utilizing compression can be replicated using any supported replication software, such as Native Synchronous Block Replication or Native Asynchronous Replication to any supported destination system. All data replicated, regardless if it is local replication or to a remote system, is first uncompressed then replicated to the destination. This method of replicating compression enabled storage resources ensures that all replication topologies are supported as if compression is not enabled on the resource. Replicating to systems which do not support compression is also supported, such as replicating to Dell EMC UnityVSA or a physical Dell EMC Unity system not running a code version which supports compression.

Dell EMC Unity Compression can also be enabled on only the source, only the destination, or both the source and destination storage resources, depending on if the system and Pool configuration support Dell EMC Unity Compression. This allows the user to fully control where to implement compression. One example of a supported replication configuration is when utilizing Asynchronous Local Replication. The source storage resource may reside on an All Flash Pool and have compression enabled, but the destination may be

on a large capacity Hybrid Pool which does not support compression. Another example of a supported configuration is when replicating a storage resource from a Dell EMC UnityVSA system or a production system not utilizing compression, to a storage resource with compression enabled on a remote system. Replication can also occur between a resource created before the system was running Dell EMC Unity OE version 4.2, and one after.

More information on Replication can be found in the *Dell EMC Unity: Replication Technologies* white paper found on Dell EMC Online Support.

## SNAPSHOTS

The Dell EMC Unity Snapshots feature is fully supported with compression. Snapshots also benefit from the space savings achieved on the source storage resource. When taking a Snapshot of a compression enabled storage resource, the data on the source may be compressed. The data is left in its compressed state, and the Snapshot inherits the savings achieved on the source storage resource.

When a snapshot is mounted and the source storage resource has compression enabled, compression is also utilized on any snapshot I/O. If a read is received for a compressed block of data, the data is uncompressed and sent to the requestor. Savings can also be achieved on writes to a snapshot. As write operations are received, if the source storage resource has compression enabled, snapshot writes are also passed through the compression Algorithms. This savings is tracked and reported as part of the GBs saved for the source storage resource.

More information on Snapshots can be found in the *Dell EMC Unity: Snapshots and Thin Clones* white paper found on Dell EMC Online Support.

## THIN CLONES

Thin Clones were first introduced in Dell EMC Unity OE version 4.2. A Thin Clone is a read-write copy of a Thin Block storage resource, such as a LUN, Consistency Group, or VMware VMFS Datastore, that shares blocks with the parent resource. Along with sharing blocks with the source, Thin Clones also share the compression setting, which can only be set on the base storage resource. When compression is enabled on the source storage resource, any writes to a Thin Clone are also passed through the compression algorithm. All savings achieved on Thin Clones are also reported as a cumulative total with the savings on the source storage resource.

Compression can be enabled or disabled on the source storage resource at any time. Changing the compression setting will also control if compression is enabled or disabled on all Thin Clones residing on the storage resource. When compression is enabled on the source, no existing data is compressed unless overwritten. When compression is disabled, all data is left compressed. While a Thin Clone exists for a storage resource, Local LUN Move and Compress Now are not available on the source. Also, Local LUN Move and Compress Now are not available for use on a Thin Clone.

More information on Thin Clones can be found in the *Dell EMC Unity: Snapshots and Thin Clones* white paper found on Dell EMC Online Support.

## DELL EMC UNITY NATIVE FILE AND BLOCK IMPORT

Dell EMC Unity Native File and Block Import was first introduced in Dell EMC Unity OE version 4.1. In this release, VNX1 or VNX2 Block and File (NFS) resources could be migrated to Dell EMC Unity using the native import feature. In Dell EMC Unity OE version 4.2, support for Import was extended to VNX1 or VNX2 File (CIFS) configurations. When configuring an Import Session, compression is supported on the destination as long as the destination system supports compression and the target storage resource resides on an All Flash Pool. When creating an Import Session, if the target resource supports compression, a checkbox is available to enable compression on the destination resource. As data is migrated from the source VNX system to the Dell EMC Unity system, it is compressed as it is written to the Pool.

More information on Dell EMC Unity Native File and Block Import can be found in the *Dell EMC Unity: Migration Technologies* white paper found on Dell EMC Online Support.

## POOL EXPANSION

Expanding a Pool which contains compression savings is only supported if it is being expanded by supported Flash Drives. For instance, a Pool containing SAS Flash 2 or SAS Flash 3 drives can be expanded by adding more SAS Flash 2 or SAS Flash 3 drives to the Pool. While storage resources exist within the Pool which have compression enabled or have had compression enabled in the past, adding SAS or NL-SAS drives to convert the Pool to a Hybrid Pool is not supported.

To expand and convert an All Flash Pool to a Hybrid Pool, all storage resources which have compression enabled or have used compression must be removed from the Pool. For Block resources, Local LUN Move can be used to move the resource's data to another resource on the same Pool with compression disabled, or to another Pool. When utilizing Local LUN Move to relocate a Block device within the same Pool, you must ensure compression is disabled on the destination device. For File resources, the data must be migrated to a new resource, either by leveraging Dell EMC Unity Asynchronous Replication or a host based migration tool. Once all resources which have utilized compression have been removed from the Pool, the expansion will be allowed.

More information on migration options can be found in the *Dell EMC Unity: Migration Technologies* white paper found on Dell EMC Online Support.

## CONCLUSION

With the release of Dell EMC Unity Compression, Dell EMC Unity storage systems now offer a powerful capacity efficiency feature which can improve the effective capacity utilization of a Dell EMC Unity system. Compression is included with all physical Dell EMC Unity systems at no additional cost. When compression is utilized, not only is space saved due to the storage resources being Thin, but compression savings are achieved as well. Dell EMC Unity Snapshots and Thin Clones also save space within the system, which can greatly reduce the amount of storage needed for a dataset. By reducing the amount of storage needed to store a dataset, Dell EMC Unity Compression helps to further reduce the Total Cost of Ownership of a Dell EMC Unity system.

## REFERENCES

### White Papers

- Dell EMC Unity: Data Reduction
- Dell EMC Unity: Unisphere Overview
- Dell EMC Unity: Introduction to the Platform
- Dell EMC Unity: Snapshots and Thin Clones
- Dell EMC Unity: Replication Technologies
- Dell EMC UnityVSA
- Dell EMC Unity: Data at Rest Encryption
- Dell EMC Unity: FAST Technology Overview
- Dell EMC Unity: Migration Technologies
- Dell EMC Unity: Best Practices Guide

### Other References

- Dell EMC Online Support
- Dell EMC Unity InfoHub (<http://bit.ly/unityinfohub>)
- Unisphere Command Line Interface User Guide