VxFlex OS 3.0

New features: Volume migration and limitations

Abstract
This paper is a handy reference guide which describes the new volume migration feature in VxFlex OS v3.0. Migration use cases and limitations are also covered.

June 2019
Revisions

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<th>Description</th>
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</thead>
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<tr>
<td>October 2019</td>
<td>Initial release</td>
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Author: Neil Gerren

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Executive summary

Volume migration is a new VxFlex 3.0 feature which enables VxFlex OS customers to move their data as needed between storage pools and protection domains. This presents a new opportunity to tier your data, not only based on the performance of the underlying media, but also based on the compressibility of the resident data sets. It provides an avenue for migrating "legacy" data into new compressed fine-grained storage pools. It provide for many other use cases such as capacity management between storage pools and/or protection domains, or migrating data from one protection domain to another to further eliminate risk from maintenance activities.

There are a few limitations to consider when migrating volumes. This paper will discuss those limitations to ensure the best migration experience.
1 Prerequisites for volume migration

While this chapter focuses on migration to or from fine granularity storage pools, migration between medium granularity storage pools is supported, so in this specific use case, these prerequisites are not actually required.

Before leveraging volume migration and new features like compression and persistent checksums, you must install or upgrade to VxFlex OS v3.x. When upgrading to VxFlex OS, the normal upgrade processes you’re already familiar with still apply. The differences lie in the requirements for fine-grained storage pools.

Once your 3.0 upgrade has completed, you need to:

- Install “libpmempmem” and “ndctl” RPM files
- Disable the NVDIMM interleave BIOS option of the server
- Install NVDIMM devices in your SDS nodes (if they’re not already there)
- Create the DAX logical acceleration devices
  - Refer to the version 3 Configure & Customize guide, Chapter 5 for more detail
- Create your first acceleration pool, which is also mentioned in Chapter 5
- Install new SSDs, or at least have unused SSDs installed in your SDS chassis
- Create one or more fine-grained storage pools, assigning your new acceleration pool to the new fine-grained storage pool

The full detail for the above steps were listed above to give you additional context and insight. Refer to the VxFlex OS 3.0 deployment guide for more detailed instructions which would also include any new version-specific instructions.

Once you have at least one fine-grained storage pool, you can go ahead and migrate volumes into the new pool. The migration feature was added to initially give you the ability to migrate any medium-grained pool contents to fine-granularity pools, but other migration uses cases are also included as mentioned above.
2 Volume attributes affecting migration

There are only two volume attributes that determine whether you can migrate a volume:

- Thick or thin provisioning
- Zero Padding

Also, it is important to understand that the new fine-grained storage pools support only:

- Thin provisioning
- Zero padding

When migrating from medium-grained storage pools to fine-grained pools, the provisioning option is “forgiving,” but the padding option is not. This means that a zero padded medium-grained volume can be migrated whether it’s thin provisioned or not. It also means that the medium-grained volume MUST be zero padded in order to migrate it to a fine-grained storage pool. Keep in mind these limitations may change in the future.

2.1 Volume attribute permutations of migration

The above limitations expand into numerous possible permutations. The following chart provides more clarity as to which attributes for a given storage pool type can actually be migrated from a given storage pool type, to a given type:

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<thead>
<tr>
<th>Source (SP)</th>
<th>Destination (SP)</th>
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<tbody>
<tr>
<td>MG</td>
<td>FG</td>
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<tr>
<td>Non-Zero Padded</td>
<td></td>
</tr>
<tr>
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<td>Thick</td>
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<table>
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<tr>
<td>✓ *</td>
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From the above table we can conclude the following:

- A medium-grained thick provisioned volume can be migrated to a medium-grained thin provisioned storage pool provided the migration force flag is checked
- Migrating volumes on fine-grained storage pools to other fine-grained pools require little forethought other than ensuring you have sufficient capacity in the target storage pool
- Volumes residing in medium-grained storage pools must be zero padded when migrating to fine-grained storage pools
3    Initiating the volume migration process

3.1    The new volume migration wizard

In VxFlex OS v3.0, we have a few new volume views. Select the view highlighted in blue as seen below:

Next see that we have both a fine-grained and a medium-grained storage pool. Notice the encircled “F” designating the fine-grained pool “fg1.”

Something that is worthy of mention at this point is the fact that volumes under-load can be migrated on the fly, even between protection domains! Several migration requests can be queued, but only one runs at any given time. After volume migration is initiated, a new volume of the same name is created in the target storage pool, and new writes are directed to that new volume as the migration proceeds.

We have a volume named “testvol3” in our medium granularity storage pool that we wish to migrate. We right-click on it to instantiate the volume migration wizard:
The V-Tree migration wizard is displayed. We need only select the target storage pool and any advanced options. See that while the default behavior of the “fg1” storage pool is “compression-enabled,” we have the option as to whether we want the new target volume to be compressed:

See that you can also:

- Prioritize the migration
- Ignore the current capacity of the target pool
- Convert the existing V-Tree to thin-provisioned
- Preserve the existing V-Tree

Clicking “OK” starts the migration process.

### 3.2 The new volume migration monitor
During active migrations, the volume migration view becomes an active migration monitor. The monitor view shows the flow of data in and out of the active migration volumes and storage pools. It also provides an indication of percentage completion and current status.
3.3 A change to the UI Dashboard

The UI Dashboard view has always had the ability to display back-end workloads such as rebuild or rebalance. Migration workload is now available as seen here:
Throttling migration workload

Obviously, like rebuild & rebalance processes, volume migration can potentially affect your production workloads. To mitigate this as a potential issue, we’ve added the capability of throttling the migration workload using the I/O priority wizard found in the Backend -> storage pool menu. Here, you have the choice of limiting the number of I/O threads participating in the migration by selecting “Limit Concurrent I/O”:

![Limit Concurrent I/O](image1)

The other option available controls the migration thread count while restricting the migration throughput per-SSD:

![Favor Application I/O](image2)
If you’re unsure what settings to use, have a quick look at your rebuild and rebalance settings. You’ll find those useful. Be aware that it is not recommended to set the concurrent I/O limit above 1 without talking to Dell VxFlex OS support, as it may result in excessive impact to the storage cluster. Also, the current bandwith limit is 25MB/s to minimize production workload impact.
The initial intent of migration was to give customers an ideal method of taking advantage of new VxFlex OS v3 features like compression, a smaller allocation unit, and persistent checksums. There are other drivers as well:

- Adding the element of time to enable dynamic service levels, migrating to lower latency devices, giving applications a critical boost when necessary
- Simplifying the tiering of storage pools
- Managing capacity as applications grow and shrink during accounting or manufacturing cycles
- Simplifying the migration to new storage clusters while depreciating old ones
- Migrating to secondary protection domains for DevOps or other purposes
- Migrating off Protection Domains when there is concern for maintenance activity
Volume migration is another customer-driven feature that we at Dell EMC have added to VxFlex OS. It ushers in new storage management capabilities including migration between protection domains and storage pools, enabling customers to migrate compressible data sets to dynamically created compressed volumes. It also provides for a number of IT use cases, improving storage manageability while reducing the time and effort required. These benefits roll up to the business, giving it more time to focus on the core business while reducing storage costs.

We hope you enjoy exploring the new feature set of VxFlex OS v3.x! You can now look forward to yet more enhancements in the coming months!
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