ABSTRACT
This white paper discusses and provides guidelines for users who want to utilize repurposing capabilities of Dell EMC AppSync® when their application environment is hosted on a Dell EMC Unity® All Flash family storage system using AppSync as their application protection tool.

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EXECUTIVE SUMMARY

This document provides technical information about utilizing copy repurposing capabilities of AppSync software with Dell EMC Unity All Flash family storage systems, including the environmental caveats that should be taken into consideration when using both AppSync and Dell EMC Unity Flash for copy repurposing. This document also provides guidance on utilizing Dell EMC Unity’s Thin Clone feature technology in the AppSync software environment.

AUDIENCE

This white paper is intended for application and/or storage administrators who are currently administering AppSync in their environment, Dell EMC internal field personnel, as well as partners who assist customers with deploying AppSync.

INTRODUCTION

Dell EMC AppSync is software that enables Integrated Copy Data Management (iCDM) with Dell EMC’s primary storage systems. AppSync simplifies and automates the process of generating and consuming copies of production data. By abstracting the underlying storage and replication technologies, and through deep application integration, AppSync empowers application owners to satisfy copy demand for operational recovery and data repurposing. In turn, storage administrators need only be concerned with initial setup and policy management, resulting in an agile, frictionless environment. AppSync automatically discovers supported applications, learns their layout structure, and maps them through the virtualization layer, to the underlying storage devices. AppSync then orchestrates all the activities required from copy creation and validation, through mounting at the target host and recovering the application. Supported workflows also include refresh, expire, and restore operations.

USING THE GUIDELINES

The information and guidelines described in this document have been provided by the AppSync Corporate Systems Engineering group. This information is supplemental, and should be used in conjunction with other AppSync documentation, including the AppSync User and Administration Guide, the AppSync Installation and Configuration Guide, and the version specific Release Notes. AppSync’s terms seen directly within the user interface (UI) are bolded in blue. This provides a direct link to what is seen within the user console, offering clearer readability. For example, within the user interface, there is a menu called Settings where you can click Storage Infrastructure which provides a wizard to add storage arrays. As seen in Figure 1 - AppSync Console UI. The words in blue are seen verbatim.

Figure 1 - AppSync Console UI
TERMS AND DEFINITIONS

AppSync uses terms that may also be used commonly in the industry, which may have a slightly different meaning, or perhaps a very specific versus general meaning. The following terms which are defined below, should help provide guidance.

- **Base LUN [Group]** - The founding Dell EMC Unity LUN [Group] which has a set of derivative Snapshot and Thin Clone objects.
- **Expire** – A process flow of removing copies from within the AppSync UI, and also removing the copy on the array.
- **Mount Host** – The host where the copy is presented/where the mounted the copy resides - an alternate host or same as source.
- **Mount Point** – A location used by the mount operation, which uses an existing mounted file system as a directory tree for the copied volume mount location. This is the default AppSync mount location.
- **Object** – Any database, file system, application, or datastore, to which AppSync manages. ACLs are applied to these items. Objects are either subscribed to service plans or are repurposed individually.
- **Recover** – A process flow of extending the copy and mount operation, by also starting the application once mounted, such as bring a SQL or Oracle database online, on a mount host.
- **Repurposing Workflow** – A copy management workflow process, similar to the Service Plan workflow, providing a multi-generation copy process. Repurposing workflows are managed through **Copy Management**.
- **Restore** – A process flow of overwriting the source volume with the contents of a copy created previously.
- **Service Plan** – A copy management workflow template used for protecting applications.
- **Snapshot** - A point-in-time copy of a LUN.
- **Subscribe** – The act performed on or against an object, as to how it gets associated to a service plan. Runs with the service plan, utilizing the service plan’s settings for copy management.
- **Thin Clone** – A read-write copy of a Dell EMC Unity block level storage resource (LUN, LUN within Consistency Group, or VMFS Datastores) snapshot.

ARCHITECTURE AND REQUIREMENTS

APPSYNC ARCHITECTURE

A typical AppSync architecture has three major components including the AppSync server, the host plug-in software, and the AppSync console.

- The AppSync server software resides on a Windows virtual or physical system and controls workflow activities, manages alerting and monitoring, and stores the information within an internal PostgreSQL database.
- The host plug-in is light-weight software installed on all source and any mount host, providing AppSync the ability to integrate with the operating system and optional applications, such as Microsoft Exchange and SQL, Oracle, or operating system file systems. In the case of VMware datastore replication, there is no host plug-in as AppSync communicates directly with the vCenter server.
- The AppSync console is a web-based interface used to manage AppSync. The console is generally used directly on the end user’s laptop or on another server, requiring only a supported browser environment. Alternatively, VSI, REST API, and CLI can be used to manage the environment.

**Note:** The AppSync console is compatible with Google Chrome, Internet Explorer and Mozilla Firefox. Adobe Flash Player version 10.2 or higher is required to run the AppSync console.\(^1\)

For more information about each component, refer to the **AppSync Installation and Configuration Guide**, the **AppSync User and Administration Guide**, and to validate supported versions, please refer to the latest **AppSync Support Matrix**.

\(^1\) (AppSync 3.5 Installation and Configuration Guide, 2017)
APPSYNC PREREQUISITES

- The AppSync server and host plug-in software are assumed to be installed and configured, with the host’s applications discovered, as well as any vCenter server configured if applicable, according to the AppSync Installation and Configuration Guide.

- For utilizing AppSync repurposing capabilities with Dell EMC Unity Storage systems, a minimum of AppSync version 3.5 is required².

- An AppSync user with the Resource Administrator role is required to add the Dell EMC Unity system to AppSync.

DELL EMC UNITY PREREQUISITES

AppSync creates Dell EMC Unity Snapshots & Thin Clones of the application data and names them with the prefix AppSyncSnap or AppSyncClone respectively.

- In order to support Dell EMC Unity repurposing workflows with AppSync 3.5, the minimum Dell EMC Unity OE version must be 4.2².

- In order to enable Dell EMC Unity Snapshots & Thin Clones, the system must be registered to the AppSync infrastructure using the AppSync console.

- In order to add the Dell EMC Unity system to AppSync, credentials for a global user with the Administrator or Storage Administrator role are required.

- Each Dell EMC Unity system requires a valid AppSync license that must be configured using the AppSync console. This includes AppSync Starter Bundle licensing.

- AppSync supports repurposing the following applications when hosted on Dell EMC Unity Storage systems:
  - Microsoft SQL Server and Oracle databases
  - Microsoft Windows, Linux, and AIX file systems

  Note: Please refer to the Service plan overview table in the AppSync User and Administration Guide, which depicts the latest applications supported under the repurposing workflow.

² (AppSync Release Notes, 2017)
**REGISTERING DELL EMC UNITY**

**ADDING THE DELL EMC UNITY SYSTEM TO APPSYNC**

Creating Dell EMC Unity repurposing copies with AppSync, first requires adding the Dell EMC Unity storage system to AppSync, and then apply licensing. To add a Dell EMC Unity system, navigate to **Settings > Storage Infrastructure**, and then selecting **Unity** from the **Add** drop down box, as seen in **Figure 2 - Adding Unity**.

![Figure 2 - Adding Unity](image)

**LICENSE THE UNITY SYSTEM**

Once the Dell EMC Unity system has been added, install the proper licensing file by navigating to **Settings > Licenses** and either clicking **Obtain License File Online**, to generate the licensing file, if the LAC and sales order number are known, or if the license file (with the .lic file extension) is already obtained, clicking the **Upload and Install License File**, as seen in **Figure 3 - Installing License File**. This applies to all licensing models, including the Starter Bundle licensing model.

![Figure 3 - Installing License File](image)
THIN CLONES

A Thin Clone is a read-write copy of a Thin Block level storage resource (LUN(s), LUNs within Consistency Group, or VMware VMFS Datastores). A Thin Clone shares the underlying data block with the parent storage resource. When creating a Thin Clone, no data needs to be copied from the source. Upon creation, the data is immediately available on the Thin Clone. Any changes to the data on the Thin Clone will not affect the Base LUN and vice versa. Also, any changes to the Thin Clone will not affect the snapshot source.

There are many operations available for Thin Clones including the ability to create, view, modify, refresh and delete Thin Clones. In addition, the user can configure a number of data services for Thin Clones using Unisphere, Unisphere CLI and REST API. For example, the administrator can provide host access, configure a Host I/O limit, replicate snapshots, and set up a snapshot schedule.

Thin Clones have the same look and feel as their source LUN, LUN within Consistency group or VMware VMFS Datastore.

Thin Clones are based on pointer-based technology, which means a Thin Clone does not consume much space from the storage pool. On the contrary, Thin Clones share the space with the base resource, rather than allocate a copy of the source data for itself, which gives a lot of benefits to the user.

There are several use cases for Thin Clones:

- **Application Testing** – The users can test applications on Thin Clones before putting the applications on the production system. Therefore users can avoid putting the production system at unnecessary risk.
- **Parallel processing** – Parallel processing applications that span multiple servers can use multiple Thin Clones of a single production data set to achieve results more quickly.
- **Online backup** – The user can use Thin Clones to maintain hot backup copies of production systems. If there is corruption in the production data set, the user can immediately resume the read-write workload by using the Thin Clones.
- **System deployment** – The user can use Thin Clones to build and deploy templates for identical or near-identical environments. For example, the user can create a test template that is cloned as needed for predictable testing.
- **Application Testing** – The user can test applications on Thin Clones before putting them in production. This allows development and test personnel to work with real workloads and use all data services associated with production storage resources without interfering with production.
REPURPOSING WORKFLOW

Repurposing workflows provide different copy options such as creating application consistent local or remote array copies, automated mounting and application recovery options, as well as scheduling options. Repurposing runs against a single application, and does not utilize a copy count rotation methodology, therefore, repurposing workflows are not generally utilized for backup. Repurposing is more suitable for replicating production environments, to be used for test and/or development. More details on the repurposing workflow can be referenced in the AppSync User and Administration Guide.

With the repurposing workflows, multi-generation copies can also be created. This is to say, a 1st generation copy, or one copy removed from the source, can be created, then optionally, an additional copy, termed as the 2nd generation copy, or a copy that is twice removed from the source, can be created. Please refer to Figure 4 - Repurposing Overview, for an overview of multi-generational copies.

Repurposing workflows are generally utilized for creating copies of database applications, presenting them to alternate locations for substitution purposes; alternatively to production. Repurposing workflows are currently supported for Microsoft SQL, Oracle, and file systems. Some common repurposing use cases are, but are not limited to, the following:

- **Creating ad-hoc, or on demand**, copies of a single database to be used for an extended period of time, and then discarded – not used for backup/recovery or for maintaining copy retention.

- **Data Masking** – Creating an initial copy which is mounted, scrubbed, unmounted, and then secondary copies are created from that copy which has the obfuscated, or “masked,” data.

- **Retention on a remote array** – In order to create long term retention on a remote array, where Dell EMC RecoverPoint® transfers the production data to an alternate, or remote, array, sometimes referred to as a DR array, AppSync can utilized the repurposing workflow to create array based copies off of RecoverPoint bookmarks.

- **Snap-of-Snap** - Provide one primary, 1st generation, copy serving as the source for multiple 2nd generation copies, which can be created and utilized on their own, such as providing multiple developers with the same copy, or creating a series of identical copies for training purposes. This process alleviates having to quiesce production over and over unnecessarily.

Figure 4 - Repurposing Overview

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**REPURPOSING CONSIDERATIONS**

- Used primarily for extended periods of time and are typically discarded when done
- Repurposed copies do not figure into RPO calculations (refer to the *AppSync User and Administration Guide* on RPO alerts)
- Restore is supported from 1st generation copies only
- 2nd generation copies are not application consistent (no app discovery, mapping, freeze/thaw – unmount callouts are supported)
  - For this reason, best practices recommends that 2nd generation copies not be taken when a 1st generation copy is mounted
  - A 2nd generation copy is considered application consistent, if the 1st generation copy was taken as application consistent, and had not been mounted or altered, by the time the 2nd generation copy was taken (a 2nd generation copy is identical to the 1st generation copy, at time of creation)
- **Dell EMC Unity repurposing specifics:**
  - Requires a minimum of *AppSync 3.5* with *Dell EMC Unity OE version 4.2*
  - 1st generations must be/can only be, Snap
  - 2nd generation can be either Snap or Clone (Dell EMC Unity Thin Clone)
  - AppSync does not provide a way to mount read/only copies of Dell EMC Unity snaps or Thin Clones
  - When creating 2nd generation Thin Clones, the 1st generation snapshot cannot be in a mounted state
    - Per the *Dell EMC Unity: Snapshots and Thin Clones A Detailed Review* white paper
      
      "Prior to creating a Thin Clone, users need to create a snapshot. The snapshot can have read-only host access or be an unattached snapshot."
      
      - For AppSync, this means the 1st gen copy must not be in a mounted state, when creating or refreshing a 2nd gen Thin Clone.
    - The following error is seen if the parent snapshot is mounted, or in a read-write mode…

**Repurposing File System Copies**

Repurposing file systems together means to select multiple file systems which need to be copied together, in order to maintain consistency. Unlike other applications, such as SQL and Oracle, both Windows and UNIX file systems can be repurposed together.

Should there be a need to refresh, mount, expire, or repurpose the copy, select and perform the operation on just one file system, as AppSync will ensure the other file systems are managed together - **AppSync ensures consistency, and understands the group set being acted upon.** Per the *AppSync User and Administration Guide*:

- File systems that are repurposed together are mounted together.
- File systems that are protected together are repurposed together for second generation copies.

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4  (*Dell EMC Unity: Snapshots and Thin Clones A Detailed Review*, 2017)
REPURPOSING WORKFLOW CONFIGURATION

Previously discussed, repurposing workflows provide the ability to create a 1st, and optionally 2nd, generation copies, either locally or remotely. In order to initiate a repurposing workflow copy, first navigate to Copy Management, select the application type, then navigate down to the particular database or set of file systems wishing to repurpose, as seen in Figure 6 - Create SQL Repurpose Copy and Figure 7 - Create UNIX File System Repurpose Copy. Other applications are supported – please refer to the AppSync User and Administration Guide for more details.

![Figure 6 - Create SQL Repurpose Copy](image)

![Figure 7 - Create UNIX File System Repurpose Copy](image)
Once the application has been selected, and the **Create Repurpose Copy** button has been clicked, the **Repurpose** wizard is launched, as seen in **Figure 8 - Repurpose Wizard**.

### Create 1st gen copy vs. Create a 1st gen copy and a 2nd gen copy

Creating a repurposed copy always begins with the creation of a 1st generation copy. In the case of Dell EMC Unity, this will always be a snapshot. Once the 1st generation copy is created, any number of 2nd generation copies, either snap, thin clone, or both, can be created. The initialization wizard provides the option to create a 2nd generation copy, at the same time the 1st generation copy is created. This is for convenience and does not require the creation of the 2nd generation copy, at this time.

The following steps outline how to first create a 1st generation copy, and then at a later time, create a 2nd generation copy. This way, it is clear on how one can create multiple 2nd generation copies, once the 1st gen copy is created. The initial wizard provides the ability to create only one 2nd generation copy, and there are many times when additional 2nd generation copies are desired.

### Configuring the 1st Generation Copy

The default option within the repurpose wizard is to create a 1st generation copy as **Figure 8 - Repurpose Wizard** depicts. The **Site** options are discussed in a later section titled: **Site Settings – Local or Remote**.

Click **Next** to begin…

The following screen shots depict some differences between the types of applications being repurposed. In **Figure 9 - Repurposing SQL**, the default copy type is changed from **Full** to **Copy**. This is because the repurposing wizard is being performed on a SQL database, for which is already in a protection service plan. Repurposing copies are not generally used for protection purposes, and no two workflows should utilize a SQL “full” copy type, as full backups alter the transaction log sequence number, and would disrupt a restore operation taken from another workflow process. Please refer to the SQL section of the *AppSync User and Administration Guide* for more details on SQL settings, and also other application types being repurposed. In **Figure 10 - Repurposing UNIX File Systems**, there is a limited number of options, as compared to what would be seen when repurposing SQL or Oracle, for example. File system repurposing workflows requires the label to be entered, unlike other types of workflows, where a default label exits.
Configuring Additional Settings

The Configure storage options settings are for managing VPLEX environments, and also offer advanced VMAX configuration options. These advanced settings are not discussed within this white paper. Please refer to the AppSync User and Administration Guide and/or the AppSync Integration with VPLEX white paper for details, as they do not apply directly to Dell EMC Unity repurposing workflows. If the environment is behind VPLEX, then the proper configuration is required. Please ensure the Cluster selection and Array preference are configured appropriately.

Additionally, mounting options can now be configured. Please refer once again to the AppSync User and Administration Guide for more details, as each application type has different mount settings and options, not covered within this white paper. Generally, however, the 1st generation copy is not mounted, if planning on taking 2nd generation copies, unless using the repurposing workflow for data masking purposes.

The Advanced Settings provides options to retry VSS if timeouts occur. The default setting is to retry three times, but this can be extended, and an additional amount of time between each retry can be configured. This only applies to Windows environments.

Clicking Next to configure the Schedule settings, and to complete the wizard, initiating the 1st generation copy.
REVIEWING THE 1ST GENERATION COPY

Once the repurposing workflow completes, the 1st generation copy will be visible from two locations, under Copy Management as seen in Figure 11 - 1st Generation Copy and Figure 12 - UNIX Repurposed 1st Generation Copy Review, and also through the Repurposed Copies menu as seen on the next page, in Figure 13 - Reviewing SQL Repurposed Copies Button through Figure 16 - Reviewing File System Repurposed Copies Menu.

When reviewing file system repurposing workflows through Copy Management, only individual file systems can be reviewed, however, actions taken against any file system part of a group set, are performed against all other file systems within that same group, as seen in Figure 12 - UNIX Repurposed 1st Generation Copy Review.

Figure 11 - 1st Generation Copy

Figure 12 - UNIX Repurposed 1st Generation Copy Review

Figure 13 - Reviewing SQL Repurposed Copies Button
Figure 14 - Reviewing SQL Repurposed Copies Menu

Figure 15 - Reviewing File System Repurposed Copies Menu

Figure 16 - Reviewing File System Repurposed Copies Button
CREATING 2ND GENERATION COPIES

Once the 1st generation copy is created, creating any number of 2nd generation copies can be initiated. This is considered repurposing a 1st generation copy. Initiating a 2nd generation copy is achieved by first start from one of two locations:

1. Under the Copies menu, as seen in Figure 17 - Creating 2nd Generation SQL Copies and Figure 18 - Creating 2nd Generation UNIX File System Copies, or similarly for the relevant repurposed application, simply select the 1st generation copy and then click Repurpose.

2. Under the Repurposed Copies menu, as seen in Figure 14 - Reviewing SQL Repurposed Copies Menu and Figure 16 - Reviewing File System Repurposed Copies Menu, simply highlight the 1st generation copy to be repurposed, and click Repurpose.

Note: When repurposing file systems through the Copies menu, select just one of the file systems, as AppSync will create a 2nd generation copy based on all file systems repurposed together during the 1st generation copy. See Repurposing Considerations for more details.
SITE SETTINGS – LOCAL OR REMOTE

A local copy is created on the same frame as the source being copied. A remote copy is created by utilizing RecoverPoint in order to create copies off a remote RecoverPoint Bookmark – please see Figure 19 - Remote Repurposing Copy off of RecoverPoint Bookmark, and refer to the AppSync User and Administration Guide for more details. When selecting Remote, when the application is hosted on a Dell EMC Unity system, ensure the Use Bookmark as an intermediate step is selected. Failure to do so will assume native array remote technology is leveraged, which is not supported as of AppSync 3.5. Utilizing RecoverPoint, provides array based copies off a temporary bookmark created, which is placed into image access mode. This option provides a number of uses, such as providing copies of environments to be utilized for testing and developing on a remote, or non-production, array, or to perhaps create a copy of production at a disaster recovery site, for an extended period of time. Selecting the Use Bookmark as an intermediate step option, when the Site setting is Local, does nothing more than create a local copy, so should not be utilized.

MOUNTING AND REFRESHING DELL EMC UNITY COPIES

MOUNTING COPIES

AppSync’s mounting operations for block based copies, first takes a copy and attaches it, meaning it will make the snapshot available to the host, for I/O purposes. This process creates a dynamic Snapshot Mount Point (SMP), attaches it, and then masks the SMP to the mount host. Performing an unmount operation within AppSync, the copy is not detached, instead, AppSync simply unmasks the SMP from the mount host, maintaining the SMP.

- AppSync “attaches” a snapshot when it is mounted - creates a dynamic SMP and then masks it to the mount host
- A snapshot stays attached to the SMP even after unmounting
- The next mount operations avoids re-attaching, providing performance efficiency

It is only when the copy is expired within AppSync, i.e. clicking Expire, does the copy become detached and deleted on the Dell EMC Unity system. Additionally, AppSync does not provide an ability to mount copies as read-only, so operations which require either a read-only mounted copy, or an unattached copy, such as when creating a 2nd generation thin clone copy, require that the copy be unmounted, achieving the same prerogative.

Mounting File System Repurposed Copies

Similarly to application specific mounting operations, file system repurposing workflows can be mounted. Simply select one of the file systems in the group set, to mount. AppSync will mount the entire group, as mentioned in the previous section Repurposing File System Copies.

REFRESHING COPIES

Refreshing repurposed copies is initiated in one of two ways. One way to refresh is by using the Repurposed Copies menu, providing a holistic view of all repurposed copies for that particular application, as seen in Figure 14 - Reviewing SQL Repurposed Copies Menu and Figure 16 - Reviewing File System Repurposed Copies Menu. The alternative is to select an individual application, such
as seen in Figure 17 - Creating 2nd Generation SQL Copies and Figure 18 - Creating 2nd Generation UNIX File System Copies though click Refresh, rather than Repurpose.

REFRESHING FILE SYSTEM REPURPOSING COPIES

AppSync utilizes two types of refresh policies, Native array and AppSync Way. When AppSync utilizes the native array type of refreshing, the array’s built-in refresh technology, whatever that may be, is utilized. In the case of Dell EMC Unity:

“A snapshot refresh operation deletes the current contents of the snapshot, including any changes to the snapshot, and updates the snapshot with the contents of the source device.”

The AppSync Way of refreshing will delete the previous copy, and then create a new copy; a process which is hidden to end user. The process appears as if it is a native array refresh operation. The purpose of AppSync using its own method of refreshing, has to do with efficiency. It is sometimes more efficient to delete and create, rather than update a series of tracks.

Please refer to the following table, for when AppSync utilizes native vs. AppSync's way of refreshing:

**Note**: Please note that Thin clones always use the Native array refresh type

<table>
<thead>
<tr>
<th>1st Gen &quot;Attached&quot;</th>
<th>Windows</th>
<th>Unix</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>1st Gen Refresh</td>
<td>2nd Gen Refresh</td>
</tr>
<tr>
<td>No</td>
<td>AppSync Way</td>
<td>AppSync Way</td>
</tr>
<tr>
<td>Yes</td>
<td>AppSync Way</td>
<td>Unity Native</td>
</tr>
</tbody>
</table>

Table 1 - Native Array vs. AppSync Way Refreshing

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5  (Dell EMC Unity: Snapshots and Thin Clones A Detailed Review, 2017)
CONCLUSION

In conclusion, this whitepaper explains key information and concepts when repurposing an application residing on Dell EMC Unity All Flash block storage using AppSync. It discusses the inner operations of AppSync software while protecting applications using Dell EMC Unity Snapshot and Thin Clone technologies, as well as deployment steps.

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