Abstract
This white paper provides guidelines for users who are integrating their application environment hosted on a Dell EMC Unity block, or file, storage system using Dell EMC AppSync as the application protection tool.

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EXECUTIVE SUMMARY
This document provides technical concepts when providing copy management for Dell EMC Unity storage arrays using AppSync, including identifying known environment caveats; which should be taken into consideration when using AppSync and Unity. This document provides guidance while deploying AppSync in environments where application data resides on a Unity storage system.

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

INTRODUCTION
Dell EMC AppSync 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 definition management, resulting in an agile, frictionless environment. AppSync automatically discovers the application, learns of the layout structure, and maps it through the virtualization layer, to the underlying storage device. AppSync orchestrates all the activities required from copy creation and validation through mounting, at the target host, and launching, or recovering, the application copy. The supported workflows additionally include refresh, expire, and restore production.

USING THE GUIDELINES
The information provided in this document has been provided by the Dell EMC AppSync Engineering team. This information is supplemental and should be used in conjunction with the standard AppSync documentation, found on support.emc.com, including the AppSync User and Administration Guide, the AppSync Installation and Configuration Guide, as well as the version specific AppSync Release Notes. The teams terms used in this document, which directly correlates, or is seen directly, within the user interface (UI) are bolded in blue. 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 - User Interface, the words in blue are seen verbatim.

![Figure 1 - User Interface](image-url)
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.

- **Asynchronous Replication (Dell EMC Unity)** – 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).

- **Base LUN [Group]** - The founding Dell EMC Unity LUN [Group] which has a set of derivative Snapshot and Thin Clone objects.

- **Consistency Group (Dell EMC Unity)** – 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.

- **Expire** – A process flow of removing copies from within the AppSync UI, and also removing the copy on the array

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

- **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 filesystem as a directory tree for the copied volume mount location. This is the default AppSync mount location.

- **Object** – Any database, filesystem, 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.

- **Recovery Point Objective (RPO)** – The acceptable amount of data, measured in units of time, which may be lost due to a failure. For example, if a storage resource has an RPO of 1 hour, any data written to the storage resource within the most recent hour may be lost when the replication session is failed over to the destination storage resource.

- **Replication Session** – A relationship configured between two storage resources of the same type, on the same or different systems, to automatically or manually synchronize the data from one resource to another.

- **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. There are three built-in types in AppSync as mentioned below.

  - **Service Plan Bronze** - Creates copies of protected application database on the local storage where production is located

  - **Service Plan Silver** - Creates copies of protected application database on the remote storage array.

  - **Service Plan Gold** - Creates copies of protected application database on the local and remote storage arrays. Two copies gets created.

- **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.

- **Snapshot** – A snapshot is a point-in-time copy 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.

- **Snapshot Shipping (Dell EMC Unity)** – Asynchronous Replication supports the replication of read-only block snapshots locally or to a remote site along with the storage resource’s data. Snapshot Replication can be enabled on all resources that support Asynchronous Replication, including: LUNs, Thin Clones, and Consistency Groups etc.

  **Note:** To support snapshot replication, both the source and destination systems must be running Dell EMC Unity OE version 4.2 or later.
• **Storage Resource** – The top-level object a user can provision, associated with a specific quantity of storage. All host access and data protection activities are performed at this level. In this document, storage resource refers specifically to those which support replication: LUNs, Consistency Group etc.

• **Synchronous Replication (Dell EMC Unity)** – A replication mode in which the host initiates a write to the system at a local site and the data must be successfully stored in both local and remote sites before an acknowledgement is sent back to the host.

• **Thin Clone** – A Thin Clone is a read-write copy of a Dell EMC Unity Thin Block storage resource (LUN, Consistency Group, or VMware VMFS Datastore) that shares blocks with the parent resource. On creation of a Thin Clone, the data will be available to present to a host as needed. Any changed data on the Thin Clone will not affect the base resource and vice versa. Also, any changes to the Thin Clone will not affect the snapshot source.

### ARCHITECTURE AND REQUIREMENTS

#### ABOUT THE APPSYNC ARCHITECTURE

The architecture of AppSync has three major components: the AppSync server, AppSync host plug-ins, and the AppSync user interface.

• The **AppSync server** is deployed on a Windows server system, either physical or virtual, and controls all workflow activities, manages the alerting and monitoring aspects, and persists internal data in a PostgreSQL database.

• The **AppSync host plug-ins** are installed on all source and mount hosts, providing the ability to integrate with the operating systems, and the applications hosted on those operating systems. This includes such applications as Microsoft Exchange, Microsoft SQL, Oracle, or VMware datastores. In the case of VMware datastore replication, there is no host plug-in, as AppSync communicates directly with the vCenter server.

• The **AppSync user interface** is typically a web-based interface, or graphical user interface (GUI), used specifically for AppSync world class copy management features, however, AppSync can also be managed using a vSphere VSI plug-in, RESTapi, as well as a command line interface (CLI).

**Note:** 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*.

#### ABOUT THE DELL EMC UNITY ARRAY

AppSync supports block FC and iSCSI protocols, as well as NFS file storage on Unity arrays, however does not support CIFS.

• **Unified Snapshots** are supported on block (FC and iSCSI) resources (LUNs, Consistency Groups, Thin Clones, VMware VMFS Datastore) as well as file resources (Filesystems, VMware NFS Datastore). Unity OE version 4.2 and later supports Unity Thin Clones.

• **Native Asynchronous Replication** provides local, remote, both local & remote protection. **Native synchronous replication** is supported on block resources (LUNs, Consistency Groups, and VMware VMFS Datastores).

• **Dell EMC UnityVSA** is a Software Defined Storage (SDS) solution that runs as a VMware vApp on the VMware ESXi Server platform. It provides a flexible storage option for environments that do not require purpose built storage hardware.

**Note:** For more information on Unity, refer to the following whitepapers: *Dell-EMC-unity-introduction-to-the-platform*, *Dell EMC Unity Replication Technologies*, and *Dell EMC Unity: Snapshots and Thin Clones A Detailed Review*. 
APPSYNC AND DELL EMC UNITY 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.

• In order to support Unity Native Replication, a minimum of **Unity OE version 4.2** and **AppSync version 3.8** is required, and both the local and remote Unity arrays must be registered within AppSync.
  - Each Dell EMC Unity system requires a valid full AppSync license that must be configured using the AppSync console.

• Add the Dell EMC Unity systems to AppSync, ensuring the AppSync user has the Resource Administrator role.

• AppSync creates local, remote, or both local & remote snapshots and Thin Clones of application data, and names them with the prefix **AppSyncSnap** or **AppSynClone** respectively.

• AppSync supports Unity Native Replication for block storage
  - Neither VVols nor file storage is supported as of AppSync 3.8

• AppSync supports two types of Unity Native Replication types, **Synchronous** and **Asynchronous** replication

• All typical workflows, such as protecting applications using the Bronze, Silver, and Gold Service Plans, repurposing local and remote copies, and mounting, refreshing, and restoring copies are supported.
  - Please refer to the **AppSync User and Administration Guide** for more details on what functions are supported for each type of application

• AppSync support Unity file storage with the following limitations
  - NFS 4.x is supported with Unix/Linux NFS filesystems. NFS 4.x version filesystems used as VMWare NFS datastores are not supported, thought NFSv3 for NFS datastores are.
  - Unity file storage carved from VMWare virtual disks, from NFS datastores, is supported by Oracle and Unix filesystem applications only
  - AppSync repurposing workflows are not supported with Unity file storage
  - AppSync does not support creating remote/target snapshots of Unity Native Replication sessions created for any File storage resource.

**Note:** Please refer to the **Service plan overview** section in the **AppSync User and Administration Guide**, which depicts the latest support for each Unity replication type.

REGISTERING DELL EMC UNITY

ADDING THE DELL EMC UNITY SYSTEM TO APPSYNC

Add a Dell EMC Unity system by navigating to **Settings > Storage Infrastructure**, and then selecting **Unity** from the **Add** drop down box, as shown in **Figure 2 - Adding Dell EMC Unity to AppSync**.
**LICENSE THE UNITY SYSTEM**

It is necessary to apply a proper license 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, depicted with the `.lic` file extension, is already obtained, **Upload and Install License File**, as shown in Figure 3 - Applying the Unity License. This applies to all licensing models.

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**Figure 2 - Adding Dell EMC Unity to AppSync**

**Figure 3 - Applying the Unity License**
PROTECTING AN APPLICATION USING APPSYNC

AppSync protects Microsoft Exchange, Microsoft SQL databases, Oracle, VMWare datastores, and Windows, Linux, and AIX filesystems.

During the execution service plans and repurposing workflows, AppSync executes three main phases: application discovery, application storage mapping, and the application protection, or copy, phase.

- **Application Discovery** - AppSync identifies the application, checks if the application is in a good state for protection, and then proceeds to the mapping phase.

- **Application Storage Mapping** - AppSync maps the application to storage in order to identify the LUN/device details, such as WWNs, NFS filesystem details, export path and NAS server information, and storage layout information. AppSync checks if the storage configurations, such as the replication session, are in a good state for protection. If not, an appropriate error is displayed.

- **Application Protection** – AppSync places the application in a state to create a consistent copy on the array, then resumes the application, by default, and depending on the type of application. There are options, dependent again on the type of application, which do nothing with the application, creating an array crash consistent copy.
  - **With block storage**, AppSync creates local copies of the application using the Bronze Service plan or Local Repurpose workflow.
  - **With NFS file storage**, AppSync creates local copies of the application using the Bronze Service Plan.
  
  **Note**: Provide Read-Write, Allow root access to NFS Filesystems on Unity arrays in order to protect them using AppSync.

  - **With block storage, and replication sessions configured**, either Synchronous or Asynchronous:
    - AppSync creates local copies using the Bronze Service Plan or Local Repurpose workflow.
    - AppSync creates remote copies using the Silver Service Plan or Remote Repurpose workflow.
    - AppSync creates simultaneous local and remote copies using the Gold Service Plan (repurposing workflows do not support simultaneous local and remote copies).

**Note**: Refer to the Repurposing section in the AppSync User and Administration Guide, for more details on repurposing copies on Unity, including details on how AppSync manages Unity Thin Clone technology.

**Figure 4 – MS SQL Bronze Service Plan Event Dialog** depicts the events seen during a typical Bronze service plan, protecting a Microsoft SQL database located on a Unity array.
Figure 5 - MS SQL Silver Service Plan Event Dialog depicts the events seen during a typical Silver Service Plan protection workflow of a Microsoft SQL database located on a Unity array using Asynchronous native replication.

<table>
<thead>
<tr>
<th>Date and Time</th>
<th>Phase</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wed 06/06/2018 04:13:39 AM</td>
<td>Create remote copy</td>
<td>Performing an demand sync operation on replication session with id: 8164378670_13F654F6D11_0000_8164378670_VIRT-0691FFD6A_0000</td>
</tr>
<tr>
<td>Wed 06/06/2018 04:13:39 AM</td>
<td>Create remote copy</td>
<td>Performing an demand sync operation on replication session with id: 4279519986_5A549E4F11_0000_4279519986_VIRT-0691FFD6A_0000</td>
</tr>
<tr>
<td>Wed 06/06/2018 04:13:39 AM</td>
<td>Create remote copy</td>
<td>Successfully performed sync operation on replication session with id: 8186854783_452508FDD11_0000_8186854783_VIRT-0691FFD6A_0000</td>
</tr>
<tr>
<td>Wed 06/06/2018 04:13:39 AM</td>
<td>Create remote copy</td>
<td>Successfully performed sync operation on replication session with id: 4279519986_5A549E4F11_0000_4279519986_VIRT-0691FFD6A_0000</td>
</tr>
<tr>
<td>Wed 06/06/2018 04:13:39 AM</td>
<td>Create remote copy</td>
<td>Successfully performed sync operation on replication session with id: 8186854783_452508FDD11_0000_8186854783_VIRT-0691FFD6A_0000</td>
</tr>
<tr>
<td>Wed 06/06/2018 04:13:39 AM</td>
<td>Create remote copy</td>
<td>Removing the intermediate snaps created on the local array.</td>
</tr>
</tbody>
</table>

Figure 6 - MS SQL Gold Service Plan Event Dialog depicts the events of a typical Gold Service Plan protection workflow of a Microsoft SQL database located on a Unity array using Synchronous native replication.

Figure 6 - MS SQL Gold Service Plan Event Dialog
REMOTE PROTECTION WITH NATIVE REPLICATION

Asynchronous and Synchronous Replication Sessions

- When using an **Asynchronous** native replication session, AppSync creates a snapshot of the application, then creates a snapshot on the remote array using **Dell EMC Unity snapshot shipping technology**. A **SYNC** operation is issued on the replication session to synchronize the data. Once the remote snapshot is created, the local snapshot is removed.

- When using a **Synchronous** native replication session, a snapshot gets created directly on the remote array, as synchronous replication session is always **In-SYNC**.

- Native Replication sessions are supported as of AppSync 3.8 with Unity OE version 4.2

DISPLAYING COPIES

View the copies created from either **Copy Management** or the **Service Plans**.

**Figure 7 - Copy Management Copies** shows how copies appear in **Copy Management**.

**Figure 8 - Service Plan Copies Tab** depicts the **Copies** tab of a Service Plan.

MOUNTING AND RECOVERING COPIES

During mounting operations, users can select a local, or remote copy when creating remote copies, for mounting and optionally, recovering, the application. AppSync attaches the target snapshot to the selected mount host, and then it is mounted after which, optional recovery operations are performed – executed options are selected during the mount process.

Snapshot remain attached after performing an unmount operations, in order to avoid having to re-attach during subsequent mount operations. This provides a performance benefit. The snapshot is only detached only when the copy is expired.

**Figure 9 - Mounting and Recovering a MS SQL Database** depicts the event dialog during a typical Mount and recover copy operation for a MS SQL database using a **Bronze Service Plan**.
Figure 9 - Mounting and Recovering a MS SQL Database

Figure 10 - Mounting a Linux Filesystem depicts the event dialog during a typical Mount operation for a Linux Filesystem using a Bronze Service Plan.
RESTORING LOCAL AND REMOTE COPIES

AppSync has the ability to restore local and remote copies in Synchronous and Asynchronous replication session scenarios.

1. When restoring a local copy with Synchronous replication sessions, AppSync:
   a. Pauses the replication session at the source storage array
   b. Restores the snapshot on the source storage resource
   c. Resumes the replication session at the source storage array

2. When restoring a remote copy with Synchronous replication sessions, AppSync:
   a. A failover occurs to the remote side, and since this is synchronous, the state of the replication session is active
   b. The replication session is paused while restoring the remote copy to the remote device.
   c. The replication session is resumed, thus updating the original source device with the copy created at the remote site.
   d. Once the state of the replication session becomes synchronized, the session is failed over to source side to get the session back to the original configuration.

3. When restoring a remote copy with Asynchronous replication sessions, AppSync:
   a. Initiates a failover event to the remote array - this being asynchronous means the state of the replication session is not active after the failover event occurs
   b. Restores the remote copy, to the remote device
   c. Initiates a resume of the replication session - an on-demand sync operations is issued, updating the original source device with the restored remote copy
   d. Once the replication session is synchronized, the session is failed over once again, back to the original source side - the session returns back to the original configuration

Note: Restoring local copies with Asynchronous replication - no operations are performed on the replication session.

Figure 11 - Restoring a Remote MS SQL Copy depicts the events seen during a typical SQL Server Restore operation of a remote Microsoft SQL database copy.
If other databases share common storage with the production database being restored, which were not protected together, AppSync displays a warning as to them being **affected entities**, as seen in **Figure 12 - MS SQL Affected Entities**.

Users must acknowledge this warning in order to proceed with the restore operation. Acknowledging the affected entities warning allows the other objects sharing common storage to also be restored. If those objects are processing IO, such as an online database, the restore operation may fail.

**REPURPOSING WORKFLOWS**

AppSync supports the creation of multi-generational Unity Snapshots and Thin Clones, with a prefix of either **AppSyncSnap** or **AppSynClone**, respectively. AppSync supports Unity repurposing workflows as of AppSync 3.5 and Unity OE version 4.2, or later.

AppSync repurposing supports a number of different types of workflows, such as creating application consistent local or remote copies, automating mounting and application recovery scenarios, as well as scheduling these operations. Repurposing workflows focus on a single application at a time, and does not utilize a copy count rotation policy, as occurs with Service Plan workflows. Therefore, repurposing workflows are not generally utilized for protecting the application, or also considered backup solutions. Repurposing is most often considered suitable for replicating production environments, and using them quality assurance testing, development, offloading reporting, patch management, to name but a few. More details on repurposing workflow can be referenced in the **AppSync User and Administration Guide**.

Repurposing workflows offer multi-generation copies. This is to say, a 1st generation copy, or one copy removed from the source, can be optionally copied to a 2nd generation copy, or a copy that is twice removed from the source.

**Figure 13 - Repurposing Overview** represents an overview of multi-generational copies-
REPURPOSING USE CASES

The following are typical repurposing use cases, which AppSync is known to be utilized. This is not an exhaustive list, rather, helps identify some of the possible workflows.

- **On-demand copies** – a copy of a single application is used for an extended period of time, and then discarded – this copy is not used for backup purposes to restore from - maintaining copy retention. Copies can be used for performing patch management testing, performance tuning against non-production environments, or offloading reporting, thus reducing the amount of IO performed against a production environment.

- **Data Masking** – a 1st generation copy is created and mounted in order for sensitive data to be masked. Once the sensitive data is masked, the copy is then unmounted in order to create a 2nd generation copy. This 2nd generation copy, which has an inauthentic version of the data, can then be utilized.

- **Remote Copy Retention** – long term retention on a remote array, sometimes identified as a disaster recovery copy, can be accomplished using repurposing. Remote copies can be created off RecoverPoint bookmarks, by selecting the Use Bookmark as an intermediate step, as seen in Figure 14 - Repurpose Intention, as well as off native replication sessions. When using RecoverPoint, however, Remote repurposing is the only way to support remote copy retention - on the remote array. AppSync supports using the Silver and Gold Service Plans with native replication for long term retention on the remote array.

- **Snap-of-Snap** – similar to a data masking requirement, repurposing supports creating a 1st generation application consistent copy of a single application, used as the source for multiple 2nd generation copies. These 2nd generation copies can then be utilized for things such as:
  - Providing multiple copies of the same point-in-time (PIT) to developers - identical copies for training purposes or to offer as a baseline for collaboration efforts
  - Alleviating the need to quiesce the production environment unnecessarily for many copies
  - Refreshing the 2nd generation copy whilst not having to change the PIT

REPURPOSING CONSIDERATIONS

- Used primarily for testing or development purposes for extended periods of time, then discarded/expired when done
- Repurposed copies do not figure into RPO calculations (refer to the AppSync User and Administration Guide for more details regarding RPO alerts)
- Restores are supported from the 1st generation copies only
- 2nd generation copies are not application consistent (no application discovery, mapping, application integration such as freeze and thaw of a database – callouts are supported for unmounting only – refer to the AppSync User and Administration Guide for more details on callout scripts)
  - For this reason, 2nd generation copies should never be taken when a 1st generation copy is mounted
• A 2nd generation copy is considered “application consistent,” if the 1st generation copy is and has also not been mounted, or more importantly, altered by the time the 2nd generation copy is taken
  – The 2nd generation copy is identical to the 1st generation copy, at time of creation
  – A mounted/altered 1st generation copy should be unmounted before creating the 2nd generation copy

REPURPOSING SPECIFICS
• 1st generation copies must be Unity Snapshots (Unity Thin Clones are not supported as 1st generation copies)
• 2nd generation copies can either be Unity Snapshots or Unity Thin Clones
• AppSync does not provide a way to mount read-only copies of Unity snapshots or Unity Thin Clones
• When creating 2nd generation Unity 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 generation copy must not be in a mounted state, when creating or refreshing a 2nd generation Thin Clone. Figure 14 - Thin Clone Error depicts the error seen if the 1st generation snapshot is mounted, or in read-write mode.

REPURPOSING FILESYSTEM COPIES
Repurposing filesystems generally encompasses selecting multiple filesystems together, which need to be copied together, in order to maintain consistency for a single application. Unlike MS SQL and Oracle databases, both Windows and UNIX filesystems 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 filesystem, or mount point, as AppSync will ensure the other filesystems are managed together - AppSync ensures consistency, and understands the group set being acted upon. Per the AppSync User and Administration Guide:
• “Filesystems that are repurposed together are mounted together.”
• “Filesystems that are protected together are repurposed together for second generation copies.”

REPURPOSING WORKFLOW CONFIGURATION
Repurposing workflows provide the ability to create 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 object, such as a database or filesystem. When repurposing filesystems, be sure and select all the filesystems at this point.

| Fri 07/28/2017 01:40:25 PM | Create 2nd gen copy | Unity array doesn't allow thin clone creation/refresh while parent snapshot is masked in read-write mode to any host. Please unmount parent copy if its mounted to any host and retry operation |

Figure 14 - Thin Clone Error
**Figure 15 - Create Repurposed Copy** depicts the start of repurposing a SQL database.

![Select one database application](image1)

**Figure 15 - Create Repurposed Copy**

**Figure 16 - Creating a Repurposed Filesystem** depicts the repurpose initiation of two UNIX filesystems.

![Click drop down](image2)

**Figure 16 - Creating a Repurposed Filesystem**

Once the object(s) are highlighted, clicking **Repurpose → Create Repurposed Copy** launches the Repurposing wizard, as seen in **Figure 18 - Repurpose Intention**.

![Repurpose Wizard Intention](image3)

**Figure 17 - Repurpose Wizard Intention**
CREATING 1ST GENERATION COPIES

Creating a repurposed copy always originates 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 the time of the creation of the 1st generation copy.

The following steps outline how to create an initial 1st generation copy and then creating a 2nd generation copy. This way, it is clear on how one can create multiple 2nd generation copies once a 1st generation copy exists.

The initial wizard provides the ability to create only one 2nd generation copy, but there may be times when many additional 2nd generation copies are required. The process one may follow for creating multiple 2nd generation copies, is as follows.

Configuring the 1st Generation Copy

1. The repurpose wizard's copy generation option default, is to create a 1st generation copy. Site options are discussed in a later section titled: Site Settings – Local or Remote.

2. Leave the default Create a 1st gen copy selected, and click Next to begin the repurposing wizard.

The following two sections depict options one would encounter repurposing that specific type of application. Refer to the AppSync User and Administration Guide for more details on each application’s copy options.

Repurposing Microsoft SQL

The default copy type is generally needed to be changed from Full to Copy. This is because the repurposing wizard is being performed on a MS SQL database, for which there 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 a full backup alters the transaction log sequence numbers, thus disrupts a restore operation taken from another workflow process.

Please refer to the MS SQL section of the AppSync User and Administration Guide for more details on MS SQL settings, and also other application types being repurposed, such as Oracle.
Repurposing UNIX Filesystems

There is a limited number of options when repurposing filesystems, as compared to repurposing MS SQL or Oracle databases. Filesystem repurposing workflows require a label to be configured, unlike other types of workflows, where a default label exits.

![Figure 19 - UNIX Filesystem Repurposing Copy Options](image)

Additional Repurposing Copies Settings

There are additional settings which can be configured for 1st generation copies only. These are described as follows:

1. The **Configure storage options** settings are for managing VPLEX and advanced VMAX configuration options. These settings are not discussed within this white paper, so please refer to the *AppSync User and Administration Guide* for more details. If an environment is behind VPLEX, then proper configuration is required. Please ensure the **Cluster selection** and **Array preference** are configured appropriately.

2. The **Advanced Settings** only applies to Windows environments, so is not seen when repurposing Oracle databases. The configuration options seen once clicked, provides an ability to retry Microsoft’s Volume Shadow Copy service, or VSS, if a timeout occurs. The default setting is to retry three times, but can be extended and an additional amount of time between each retry can be configured.

Once the copy settings have been configured, click **Next** to configure the **Schedule** settings, and then to complete the wizard, initiating the 1st generation copy.

REVIEWING 1ST GENERATION COPIES

Once the repurposing workflow completes, the 1st generation copy will be visible in two locations, under **Copy Management** and also through the **Repurposed Copies** menu.
CREATING 2nd GENERATION COPIES

Once a 1st generation copy is created, any number of 2nd generation copies can be created. This is considered repurposing a 1st generation copy. Initiating a 2nd generation repurposing job is achieved by selecting the 1st generation copy from the Copies menu under Copy Management, then selecting Repurpose, as seen in Figure 22 – Repurposing an MS SQL Copy.

Filesystem repurposing is a little different than MS SQL and Oracle repurposing, especially when it comes to creating 2nd generation copies. In order to create 2nd generation copies of a set of filesystems, navigate down into any one of the filesystems to view its copies, and then click Repurpose as seen in Figure 23 - Repurposing a Filesystem Copy. Copies which have been repurposed together as 1st generation copies, are repurposed together as 2nd generation copies. This means that a 2nd generation copy incorporates all of the filesystems which the 1st generation copy was created.
ALTERNATIVE 2ND GENERATION COPY CREATION

There is an alternative way to manage repurposed copies, including the ability to create 2nd generation copies of a 1st generation copy. Navigate to the Repurposed Copies menu, as seen in Figure 21 - Repurposed Copies Menu Button, highlight the 1st generation copy, and then click Repurpose.

REPURPOSING MOUNT OPTIONS

Mounting options can also be configured for both 1st and 2nd generation copies. Please refer to the AppSync User and Administration Guide for mounting option details, as each application type has different mount options not covered within this white paper, however, the following notes should be considered.

- The 1st generation copy is not typically mounted when planning on taking 2nd generation copies, unless using the repurposing workflow for data masking purposes - specifically changing the data on the 1st generation copy prior to creating the 2nd generation copy.
- The 1st generation copy should never be mounted while creating the 2nd generation copy since there is no application integration with the 2nd generation copy, it is an exact duplicate of the 1st generation copy. If there are IO on the 1st generation copy at the time of creating the 2nd generation copy, it is likely the 2nd generation copy will not be in a consistent state.
- Since 1st generation copies are application aware, in cases with MS SQL and Oracle, they can be recovered, however, since 2nd generation copies are not, they cannot be recovered in an automated fashion with AppSync. Post-mount scripts can be utilized for this purpose, however, and the unmount callout script will then need to be utilized prior to refreshing the 2nd generation copy. Please refer to the AppSync User and Administration Guide for more details on unmount callout scripts for 2nd generation copies.

SITE SETTINGS – LOCAL vs. REMOTE

A local copy is created on the same frame as the source being copied. A remote copy is created by utilizing either RecoverPoint or the array’s native replication technology in order to create remote copies. There is also an option to create array based copies off remote RecoverPoint Bookmarks, as seen in Figure 24 - Repurpose Intention, Use Bookmark as an intermediate step. Refer to the AppSync User and Administration Guide for more details.

One may utilize RecoverPoint in order to provide array based copies, off a temporary bookmark which is placed into image access mode, for a number of use cases. These use cases include providing copies of environments to be utilized for testing and developing on a remote, or non-production, array, or to create a copy of production at a disaster recovery site for an extended period of time.
Note: 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. This option allows for a copy to be created on the remote array, alleviating the concern for leaving a copy in image access mode indefinitely, or preventing the bookmark from rolling.

**Figure 24 - Repurpose Intention**

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**REFRESHING SQL AND ORACLE REPURPOSED COPIES**

AppSync provides the ability to refresh both 1st and 2nd generation copies, in one of two ways.

1. **Repurposed Copies** – similar to the menu seen in **Figure 21 - Repurposed Copies Menu Button**, clicking the **Repurposed Copies** button under **Copy Management**, launches a holistic view of all repurposed copies. One need to simply select the copy and click **Refresh**.

2. **Copy Management Copies** – Navigating to the **Copies** menu under **Copy Management**, such as seen in **Figure 22 – Repurposing an MS SQL Copy**, one need only select the copy and then click **Refresh**.

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**REFRESHING FILESYSTEM REPURPOSED COPIES**

AppSync utilizes two types of refresh policies for filesystem workflows:

- **Native array** – AppSync utilizes the native array’s refresh technology policy, whatever that may be. In the current case of Dell EMC Unity arrays, this constitutes as a snapshot refresh operation deleting the current contents of the snapshot, including any changes to that snapshot, and then updates the snapshot with the contents of the source device.

- **AppSync Way** – AppSync will delete the previous copy, and then create a new copy; a process hidden to end user. This process appears as if it is a native array refresh operation, however, AppSync uses its own method of refreshing for efficiency purposes - It is sometimes more efficient to delete the snapshot, and create a new one, rather than update a series of tracks.

Please refer to the following table, depicting how, and when, AppSync utilizes the two different methodologies.

**Note:** Please note that AppSync always utilizes the native array technology when refreshing Unity Thin clones.

<table>
<thead>
<tr>
<th>Windows 1st Gen</th>
<th>Windows 2nd Gen</th>
<th>Unix 1st Gen</th>
<th>Unix 2nd Gen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Generation <strong>is not</strong> “Attached”</td>
<td>AppSync Way</td>
<td>AppSync Way</td>
<td>Native Array</td>
</tr>
<tr>
<td>1st Generation <strong>is</strong> “Attached”</td>
<td>AppSync Way</td>
<td>Native Array</td>
<td>Native Array</td>
</tr>
</tbody>
</table>
CONCLUSION

In conclusion, this whitepaper explains AppSync integration with Dell EMC Unity arrays in order to create copies of application data on local and remote storage arrays, including repurposing. It also covers key information and concepts when protecting an application residing on Dell EMC Unity All Flash block and NFS file storage using AppSync. It discusses the inner operations of AppSync software while protecting applications using Dell EMC Unity Snapshot and Thin Clone technologies, concepts when repurposing an application residing on Dell EMC Unity All Flash block storage as well as other workflows like mounting and restore operations.

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AppSync Simple Support Matrix

Dell EMC Unity: Snapshots and Thin Clones A Detailed Review
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