APPSYNC INTEGRATION WITH VPLEX
Managing Copies of VPLEX Provisioned Volumes

ABSTRACT
This white paper explains how to configure and support EMC VPLEX environments within EMC AppSync. This white paper discusses copy management solutions with AppSync, for VPLEX provisioned volumes.

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EXECUTIVE SUMMARY

This document provides technical information about integrating EMC AppSync software with EMC VPLEX storage systems, including the environmental caveats that should be taken into consideration when using both AppSync and VPLEX. This document provides guidance while deploying AppSync in environments where application data is provisioned through VPLEX with EMC primary storage arrays.

AUDIENCE

This white paper is intended for EMC customers, partners, and employees who want to manage application copies of VPLEX virtual volumes. Familiarity with EMC AppSync, VPLEX, and EMC storage arrays is expected.

INTRODUCTION

AppSync is software that enables Integrated Copy Data Management (iCDM) with 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 management demands for operational recovery and data repurposing on their own. In turn, storage administrators need only be concerned with initial setup and policy management, resulting in an agile, frictionless environment. AppSync automatically discovers applications, determining the structure needed to maintain consistency, and maps them through the virtualization layer, if applicable, to the underlying storage environment. AppSync then orchestrates all the activities required, from copy creation and validation, through mounting at the target host and launching, or 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 Corporate Systems Engineering group. This information is supplemental and should be used in conjunction with other formally published AppSync documentation guides, including the AppSync User and Administration Guide, the AppSync Installation and Configuration Guide, the AppSync Support Matrix, and the version specific release notes. AppSync terms seen directly within the user interface (UI) are bolded in blue. This provides a direct correlation to what is seen with 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 access to a wizard to add storage arrays. As seen in Figure 1, the bolded words in blue are seen verbatim.

Figure 1 - AppSync GUI - Settings Menu
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 clarity guidance.

- **Expire** – A process flow of removing copies from within the AppSync UI and also removing the copy on the array, i.e. the copy is deleted.
- **Mount Host** – The host where the copy is provisioned and accessed. This is generally an alternate host, but can be the same one as the source.
- **Mount Point** – A location used by the mount operation, to which uses an existing mounted file system to attach, as a directory tree. The copied volume appears simply as a new directory to an existing file system structure. 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 repurposed.
- **Protection workflow** – See Service Plan.
- **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, ready for end user access.
- **Repurposing Workflow** – A copy management workflow process, similar to the Service Plan workflow, providing a multi-generation copy process, both based on native array and EMC RecoverPoint. It is the only way to create an array based copy off of a RecoverPoint image. 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 process, and template, for protecting applications. Service Plans are managed in their own menu and are sometimes also referred to as protection workflows.
- **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.

PREREQUISITES AND RESTRICTIONS

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.

For more information about each component, refer to the AppSync User and Administration Guide.

PREREQUISITES

- The AppSync server and host plug-in software are assumed to be installed, and the host’s applications discovered according to the AppSync Installation and Configuration Guide.
- AppSync supports both VPLEX Local and VPLEX Metro configurations. Ensure VPLEX is configured according to the VPLEX best practices.
• Not all storage arrays are supported behind VPLEX. Please make sure the storage arrays, applications, VPLEX operating environment, etc. are fully qualified according to the latest AppSync Support Matrix found on the E-Lab Navigator website.

• The following links are provided:
  o AppSync product documentation, downloads, white papers, etc.: https://support.emc.com/products/25364_AppSync
  o AppSync support matrix: https://elabnavigator.emc.com/vault/pdf/EMC_AppSync.pdf

VPLEX RESTRICTIONS AND LIMITATIONS
As of the publication of this white paper, the following known restrictions and limitations exist for supporting VPLEX configured environments with AppSync:

• Protect production copies using the Bronze level service plans and/or Local repurposing workflows

• VPLEX virtual volumes must be mapped 1:1 to an array volume as shown in

• Figure 2.

![Figure 2 - VPLEX 1:1 Mapping of Extents](image)

• MetroPoint is not supported as of this white paper. MetroPoint combines VPLEX and RecoverPoint to provide continuous data replication to a remote third site. AppSync can still protect VPLEX virtually provisioned volumes at the array level, but not at the RecoverPoint layer – AppSync does not currently support creating RecoverPoint bookmarks when using the VPLEX splitter.
  o Restoring the array copies, when in this type of configuration is not supported.
  o The following note is depicted in the AppSync User and Administration Guide: “AppSync does not support restore of VPLEX production virtual volumes, which are protected by RecoverPoint.”

• Neither concatenated (RAID-C) nor nested devices are supported

• The starter/bundle licensing model does not cover VPLEX use cases

• Please refer to the AppSync User and Administration Guide for a more exhaustive list of requirements, restrictions, and limitations.
SUPPORTED VPLEX ENVIRONMENTS

AppSync currently supports both VPLEX Local and VPLEX Metro configurations.

- AppSync currently supports EMC XtremIO, EMC Unity, EMC VMAX v3 and EMC VMAX All Flash arrays
- Neither non-EMC, EMC VNX, nor EMC VMAX v2 arrays are currently supported
- MetroPoint, or creating RecoverPoint bookmarks utilizing the VPLEX RecoverPoint splitter, is not currently supported
  - Please see previous section, VPLEX RESTRICTIONS AND LIMITATIONS, on support notes for creating native array copies when RecoverPoint is used within the environment

VPLEX LOCAL

A VPLEX Local configuration consists of a single cluster, yet provides transparent data mobility between arrays. VPLEX standardizes the LUN presentation and management, using simple tools. VPLEX improves storage utilization by using pooling, and capacity aggregation, across multiple arrays. It provides protection and high availability for critical applications, mirroring storage across mixed platforms. VPLEX leverages existing storage resources to deliver increased protection and availability for critical applications.

- The following VPLEX Local device configurations are supported by AppSync:
  - RAID 0
  - RAID 1

  Note: AppSync is tolerant of non-supported arrays on the second leg of a RAID 1 device configuration, but the copies are restricted to a supported array, configured within the AppSync UI.

VPLEX Metro

A VPLEX Metro configuration consists of two VPLEX clusters connected by inter-cluster links with not more than a 10ms Round Trip Time (RTT). VPLEX Metro transparently relocates data and applications over distance, to alternate sites, protecting the data from a site disaster - enabling efficient collaboration between sites. VPLEX Metro configurations allow for the management of storage in both data centers from one management interface. It mirrors data to a secondary site, with full access at near local speeds.

- The following VPLEX Metro device configuration is supported by AppSync:
  - Distributed RAID 1

  Note: AppSync is tolerant of non-supported arrays on the second leg of a distributed RAID 1 device configuration, but copies are restricted to a supported array, configured within the AppSync UI.
REGISTERING VPLEX

In order to manage creating VPLEX provisioned device copies with AppSync, register each array supporting the VPLEX environment first, then add all VPLEX management servers using the AppSync console. It is preferred to have the array(s) configured within AppSync prior to configuring VPLEX, but the arrays can be added secondary.

In a VPLEX Metro environment, add both cluster management servers for redundancy purposes. This will allow AppSync to continue functioning normally in case one of the management servers becomes unavailable.

1. Add VPLEX by navigating to Settings > Storage Infrastructure, and then selecting VPLEX from the Add drop down box, as seen in Figure 3.

![Figure 3 - Add VPLEX](image)

2. Enter the VPLEX management server login credentials, and then click Next.

![Figure 4 - VPLEX Credentials](image)
3. Confirm the arrays being managed are listed. If they have already been registered with AppSync, they will appear as **Configured**, otherwise appear as **Not Configured**. Click **Finish** to complete adding the VPLEX.

![Add VPLEX](image)

Figure 5 - Confirm Management Arrays

4. Optionally add the additional management server.

The VPLEX cluster is added to AppSync and displays in the storage list on the **Storage Infrastructure** page. Note that when adding just one management server in a VPLEX Metro environment, AppSync automatically discovers both clusters and displays them in the list. Clicking on either cluster in the list will display the name, or IP address, of the management server. Adding the second management server displays either, both names, or IP addresses, as seen in **Figure 6**.

![VPLEX Details](image)

Figure 6 - VPLEX Details

In a VPLEX Metro environment, it is best practice to add both management servers to AppSync. By default, the selected cluster's management server is the preferred management server. To change the preferred server, select a management server from the VPLEX Management Servers list and then click **Set Preferred**.

To change the credentials, simply highlight the management server, and click **Edit**.
WORKFLOW CONFIGURATION

There are two types of copy management workflows within AppSync, the Protect and Repurpose workflows, seen in Figure 7. For both workflows, there are specific VPLEX configuration settings which must be established in order to achieve a successful copy. Both workflows utilize the same settings; there is no difference in VPLEX configuration between workflows. Additionally, there are optional settings which provide a more customized solution.

![Figure 7 – Use Case Workflows](image)

PROTECT WORKFLOW

The protect workflow is supported using Service Plans. Service plans are templates for how copies are created. Each template includes a set of actions, called phases, which allows for customization. These customizations include the schedule for when, or how often, the copy should be created, or refreshed, the copy count retention, or number of copies to keep, a number of application specific settings, such as whether logs are backed-up for a database application or whether to create application or crash consistent copies, mount and recover options, and many more. Please refer to the AppSync User and Administration Guide for details of all the various service plan setting options.

Once a service plan is created and customized, application objects are then subscribed to that service plan. Application objects are databases, file systems, or datastores. Each type of application has different types of options to configure, such as Oracle hot-backup vs. crash consistency options, SQL transaction log truncation, Exchange differential vs. full backups, or VMware VM consistent copies, to name but a few. Please refer to Figure 8 to see which applications can be customized. If an application is not listed, AppSync offers file system service plans with optional “callout” scripts. Please refer to the AppSync User and Administration Guide for more details on supporting alternative applications with callout script support.

![Figure 8 - Service Plans](image)
AppSync provides three types of service plan templates, Bronze, Silver, and Gold, which can either be customized, or used as a template to create new service plans.

- The Bronze service plan templates are used to create local copies. It strictly used to create local copies of applications, however, in a VPLEX environment, it is also used to select where the copy is created when the VPLEX is either a RAID 1 or distributed environment. Within the bronze template configuration, an option to configure where to create the application copy is provided, by selecting the preferred VPLEX cluster, when in a distributed environment, and also which specific array, when utilizing RAID 1 volumes.

  **Note:** The Bronze service plan is the only type supported by AppSync when applications are provisioned through VPLEX.

- The Silver service plan template is used to create remote copies of an application using RecoverPoint or native array replication, such as VNX File Replicator or VMAX SRDF.

  **Note:** The Silver service plan template cannot be used to copy applications residing on VPLEX virtual volumes.

- The Gold service plan template is used to create both local and remote copies using RecoverPoint, VNX File Replicator, or VMAX SRDF/S only. The create copy phase will quiesce the application once and simultaneously create a local and a remote copy.

  **Note:** The Gold service plan template cannot be used to copy applications residing on VPLEX virtual volumes.

**REPURPOSE WORKFLOW**

The repurpose workflow is generally utilized for creating copies of database applications, and presenting them to alternate locations for repurposing purposes. Repurposing workflows are currently only supported for Microsoft SQL, Oracle, and file systems. Some common use cases for repurposing are as follows, but are not limited to:

- 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 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.

  - Alleviates having to quiesce production over and over unnecessarily

![Diagram of repurposing workflow](image-url)
Repurposing Considerations

- Used primarily for extended periods of time and are typically discarded when done
- Repurpose copies do not figure into RPO calculations (please 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, 2nd generation copies should not be taken when a 1st generation copy is mounted
- When creating 2nd generation Unity Thin Clones, the 1st generation copy must not be mounted
  - Unity Thin Clones are currently supported as 2nd generation copies only
- XtremIO Consistency Group modifications, such as adding or removing volumes, require the repurposed copy to first be expired, and then a new repurposed copy can be created. Refreshing repurposed copies in an XtremIO CG after it has been modified will fail. This is not applicable for service plan workflows, as the copy/refresh process is different.
- Always refer to the latest Release Notes, AppSync Support Matrix, and AppSync User and Administration Guide for the most current considerations and limitations.

WORKFLOW CONFIGURATION REQUIREMENTS

Mentioned previously, with the service plan workflow, also known as the protection workflow, the Bronze level service plan is utilized, even in a VPLEX Metro environment. The Repurpose workflow wizard does not utilize the same types of templates as service plans, rather, is configured on an as needed basis, per database. The repurpose workflow does provide an option to create Remote copies, as seen in Figure 10, however, this does not apply to VPLEX. VPLEX configurations are always considered Local, and in the case of Metro or RAID1 environments, the particular array at a specific location is configured using the Storage configuration options, as described in the few steps.

1. Click on Storage configuration options under Create local copy when working with service plans, as seen in Figure 11, or Create 1st gen copy with repurposing workflows as seen in Figure 12.
2. For applications running on distributed volumes, click **Cluster preference** to set the preferred site* for protection. By default, the preferred site is cluster-1, as seen in **Figure 13**.

*Note: If the copy should be created at the alternate site, simply select the cluster where the copy should exist, then proceed with selecting the array.

3. Choose **Array preference** for the storage array*, even if there is only one array per site, as seen in **Figure 14**. In the screen shot below, AppSync will create a copy at the VPLEX site ending in 11, and will attempt to first create the copy on the array ending in 854, and if that does not succeed, attempt to create the copy on the array ending in 312.

*Note: If the copy should be created on 312, only that array should be selected. Alternatively, if priority should be placed on 312, but both can optionally be used, simply drag the 312 array to the top, as the instructions on the page depict.
MOUNTING COPIES UNDER VPLEX

VPLEX MOUNT OPTIONS
AppSync provides two types of mounting options, **VPLEX virtual volume** and **Native array volume** as seen in Figure 15.

**VPLEX virtual volumes**
- This option provisions the copy through VPLEX by creating a new virtual volume and are added to the storage view of the mount host
- This is the default mount option
- The mount host/ESX environment must be zoned to the VPLEX
- RAID 0 devices are mounted as local RAID 0, and RAID 1, or distributed RAID 1, are mounted as single leg RAID 1
  - As of this publication, AppSync does not mount as a mirrored or distributed volume
  - Manually adding a mirror to RAID 1 devices must be manually removed upon unmount operations
- During unmount, the provisioned virtual volumes are removed from the storage view of the mount host and are entirely torn down through the virtual stack, leaving them provisioned on the underlying array.

**Native array volumes**
- This option provisions the copy as a native array volume
- The mount host/ESX environment must be zoned to the array where the snapshot is created

**VMware Cluster Mount**
This option, seen in Figure 16, configured by default, provisions volumes to all the nodes of the ESX cluster during the mount phase. Often in Metro environments, the arrays are not zoned to all ESX hosts and leaving this option enabled may create an error that states “Unable to find storage view in VPLEX cluster: {VPLEX cluster node name} for hosts {ESX node/host name},” as seen in Figure 17.
- Leave this option enabled to provision the copy to all ESX hosts part of the ESX cluster – storage must be zoned to all ESX hosts
- **Disable** this option to provision the volumes to just the specific ESX host, hosting the VM selected as the mount host
Note: If you are not performing a VMware cluster mount, make sure that the hypervisor is configured properly and allows dedicated LUNS to be made visible to a single host.

Note: The vCenter server managing the mount host must be registered within AppSync before you can select an ESX host as an AppSync mount host.

RESTORING COPIES UNDER VPLEX

During a restore operation, AppSync goes through various phases that will directly affect the volumes being restored.

1. AppSync removes the VPLEX virtual volume(s) from the consistency group
2. AppSync restores the volume(s) at the array level (at the LUN level)
3. When the restore is complete, AppSync adds the virtual volume(s) back to the original consistency group
4. AppSync invalidates the cache of the VPLEX virtual volume(s)

WAIT FOR MIRROR REBUILD TO COMPLETE

If the device being restored are either RAID 1 or distributed RAID 1, AppSync first restores one leg of the mirror, for which the copy was created, and then rebuilds the other leg, synchronizing it once the restore operation is complete. In some cases, this process may take a long time, primarily depending on the volume size. AppSync provides an option to accelerate the completed restore phase by disabling the **Wait for mirror rebuild to complete** check box, as seen in Figure 18. Waiting for the mirror to rebuild is selected by default, in order to provide maximum high-availability and protection.
CONSIDERATIONS

The following considerations should be taking into account, prior to restoring VPLEX provisioned copies with AppSync.

- The VPLEX production, or source, virtual volume layout must be the same as it was when the copy was initially created. If there are any changes in the production virtual volume layout, AppSync detects them and the restore operation fails.
- AppSync does not support the restore of VPLEX production virtual volumes that are also protected by RecoverPoint.
- When restoring a VPLEX volume, ensure that no other operation is performed on the volume being restored.

CONCLUSION

AppSync uses a self-service driven model to create copies for different use-cases, namely, backup acceleration, operation recovery, and data repurposing. Often, environments incorporate a combination of use-cases. Considerations are warranted and limitations should be understood when creating copies for backup acceleration, data repurposing and operational recovery of data residing on VPLEX virtual volumes. As of writing this whitepaper, AppSync supports VPLEX with limitations which are depicted in this white paper. For the latest supported environment, and for other topologies, please refer to the latest AppSync documentation references below.

REFERENCES

The following documents were used in writing this whitepaper. All documents are available at EMC’s Support site https://support.emc.com.

- AppSync 3.5 Installation and Configuration Guide
  https://support.emc.com/docu84991_AppSync_3.5_Installation_and_Configuration_Guide.pdf
- AppSync 3.5 Release Notes
  https://support.emc.com/docu84992_AppSync_3.5_Release_Notes.pdf
- AppSync 3.5 User and Administration Guide
  https://support.emc.com/docu84990_AppSync_3.5_User_and_Administration_Guide.pdf
- AppSync Support Matrix
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