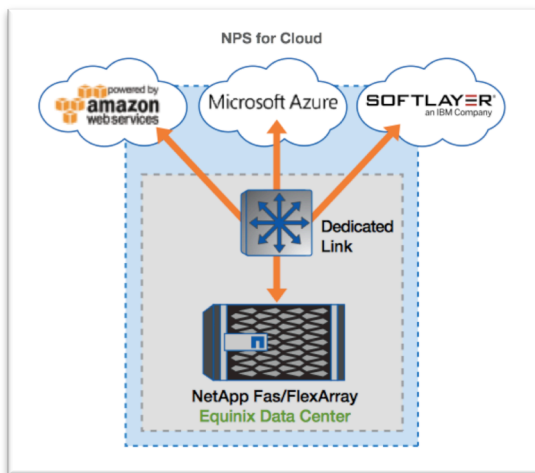


NetApp Hybrid Cloud Solutions

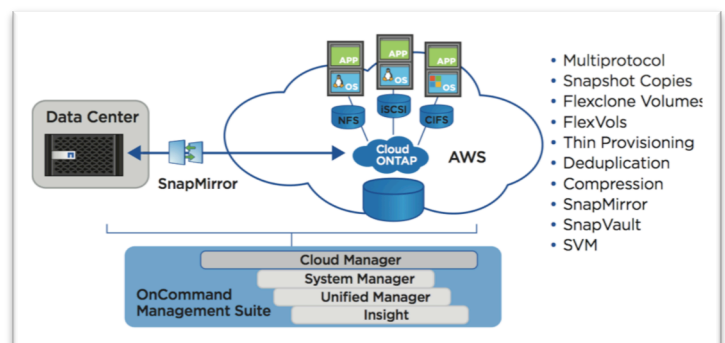
Hybrid cloud services are available from a number of vendors today, but few have the depth and breadth of functionality available from NetApp® hybrid cloud solutions, such as NetApp Private Storage, Cloud ONTAP™ and the AltaVault™ Appliance. In this paper, we will introduce a few of these capabilities and discuss three use cases. We will also provide a detailed process description of NetApp hybrid cloud solutions for backup and restore to show how NetApp solutions make it easy to take advantage of cloud services.

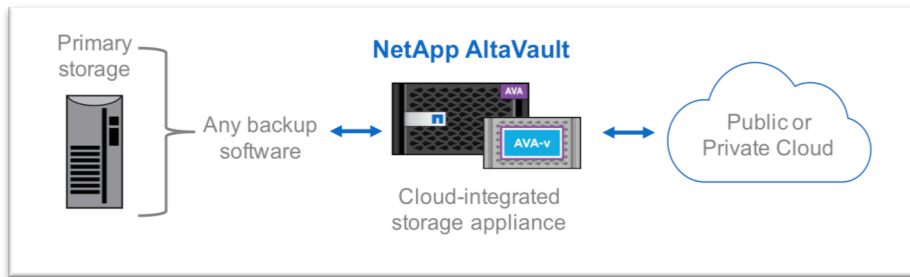
NetApp Private Storage, Cloud ONTAP and AltaVault Appliance

NetApp Private Storage (NPS) is NetApp storage systems—such as Fabric-Attached Storage (FAS) or an all-flash FAS (AFF) – residing in co-located facilities worldwide. NPS is directly connected to public cloud services such as Amazon Web Services (AWS), Microsoft Azure or IBM Softlayer. Since most public cloud storage services are used to support cloud compute, IO performance is often unpredictable and slow, while data sovereignty is out of IT's hands. In contrast, NPS supplies Data ONTAP® IO services for public cloud compute instances that can (1) provide predictable, high IO performance through direct connections to the cloud, (2) improve data sovereignty by guaranteeing data locality, and (3) maintain security and compliance by securely storing data on NetApp storage systems.



NetApp also offers **Cloud ONTAP**, which is ONTAP software that runs in the cloud and uses premium cloud services as its underlying storage. Issues with cloud storage services include limited functionality and inadequate or nonexistent integration with on-premises storage. However, with Cloud ONTAP, on-premises NetApp storage can be replicated to the cloud as often as needed in an efficient deduplicated and compressed manner. Moreover, the cloud compute environment can now ease the administrative burden for cloud applications using Cloud ONTAP's advanced storage management functionality. However, unlike NPS, which is a hybrid solution that combines on-premises and cloud-based resources, Cloud ONTAP is a purely cloud-based solution.





Finally, NetApp offers **AltaVault Appliance (AVA)** in physical, virtual, and cloud-based implementations. With an AVA running in your data center, you can simultaneously use local disk

storage and cloud storage to hold backup data. Further, the **AltaVault Cloud-based Appliance** is an AVA software implementation that executes in the cloud, which means you can use AVA cloud backup data to restore backups within the cloud compute infrastructure, such as for disaster recovery, data validation, and testing purposes. The AVA performs inline data compression and deduplication, and it automatically encrypts and replicates all backup data to cloud storage. The AVA offers cloud replication services to many public cloud storage such as Amazon S3™/S3-IA/Glacier, Microsoft Azure™ Blob storage and Google cloud standard/nearline storage, as well as private cloud storage services such as NetApp StorageGRID™ Webscale, IBM Cleversafe and EMC Atmos™

NetApp Hybrid Cloud Use Cases

All of these NetApp hybrid cloud solutions can be used in isolation or in combination to easily enable an enterprise to take advantage of cloud offerings. Some common use cases for NetApp hybrid cloud solutions include backup and restore; disaster recovery (DR); and development, test, QA and analytics (Dev/Test/QA/Analytics) activities.

NetApp hybrid cloud solutions for backup and restore

Cloud storage becomes a straightforward backup data repository for your on-premises primary data stores, including flash, when you use AVA solutions, along with your backup software. All you need do is configure your data protection systems to back up primary storage—for example, NetApp AFF —snapshots to an AVA, which are then replicated to cloud storage. As AVA local disk space fills up over time, older backup data is evicted from the appliance, making more on-premises storage available for future backup data.

In this way, the AVA local disk holds recent backup data while cloud storage provides a deeper (and optionally redundant) repository of all AVA backup data. When restores are needed, IT can use backup software to retrieve snapshot data directly from the AVA. The AVA can restore requested data from local disk and, if necessary, automatically recall any nonresident data segments from the cloud.

NetApp hybrid cloud solutions for disaster recovery

As mentioned, NPS can be used to supply high-performing Data ONTAP IO services to public cloud compute instances. NPS and on-premises NetApp storage can be especially advantageous for DR, as you can now provide predictable, highly secure cloud access to local ONTAP data using SnapMirror® and execute business-critical applications in the cloud. NetApp SnapMirror

functionality replicates on-premises AFF and FAS data to cloud-accessible NPS storage or the reverse. With NPS replication and business-critical applications able to run on cloud infrastructure, DR failover becomes merely a matter of activating NPS secondary volumes and executing your workloads in the cloud, accessing NPS storage.

NetApp hybrid cloud solutions for Dev/Test/QA/Analytics

Providing Dev/Test/QA/Analytics teams with access to current, comprehensive customer data can be an ongoing burden for IT organizations. NetApp local storage and Cloud ONTAP solutions solve this problem. NetApp ONTAP SnapVault® storage services can replicate on-premises primary flash or hybrid NetApp data to Cloud ONTAP storage and then supply access to these data replicas for Dev/Test/QA/Analytics activities in the cloud. Once replication completes, customer data is available in Cloud ONTAP, enabling engineering and other teams to perform development, testing, validation and analysis at will. Cloud ONTAP data can also be refreshed in an efficient and timely manner as needed using deduplicated and compressed data.

Process Description: NetApp Hybrid Cloud Backup/Restore Solutions

Most enterprise backup solutions support NetApp SnapManager and other NetApp API connections, which, in conjunction with application and OS quiescing, can be used to create application-consistent NetApp snapshots. Along with an AVA, these snapshots can be backed up and replicated to cloud storage for subsequent restore.

For example, **CommVault IntelliSnap for NetApp, ONTAP OnCommand Unified Manager (OCUM)** and **NetApp SnapManager** services can be used to directly request NetApp snapshots, and CommVault can be used to store this backup data onto an AVA. Once configured, a **CommCell Console** can be used to schedule a backup job in order to create a consistent, application-aware NetApp snapshot and then copy this data to a local AVA and to cloud storage. The backup process looks something like this:

1. CommVault IntelliSnap for NetApp data protection software uses application or OS APIs to quiesce an application, temporarily halting application data updates;
2. CommVault IntelliSnap for NetApp communicates with NetApp storage through OCUM and SnapManager to take a snapshot of the application's data;
3. CommVault IntelliSnap for NetApp reads, indexes, catalogues and aggregates this snapshot and other NetApp application snapshots into a backup set on its media server and then copies this data to the AVA;
4. The AVA inline compresses and deduplicates the backup set while copying the data to its internal local disk storage. At the same time, the AVA encrypts the compressed, deduplicated data segments and replicates them to a preconfigured cloud storage provider;
5. After the data is transferred from the CommVault media server to the AVA, CommVault software can restart the application and even free up storage space by erasing NetApp backup snapshots;

6. As AVA disk space fills up over time, data segments can be evicted since a complete copy of all backup data segments also resides in offsite cloud storage.

Restores with CommVault, NetApp storage and an AVA are simple as well. Once a backup has completed, administrators or users can restore data directly from the CommVault media server. When CommVault processes a request for restore, the media server uses its catalog to identify the appropriate backup set and then retrieves this data from the AVA. The AVA recalls any needed data segments from local disk or cloud storage and then reconstitutes the backup set, re-aggregating all needed data segments, rehydrating the deduplicated data and uncompressing the data before passing it on to the CommVault media server for restore.

Most other backup software providers, such as IBM Spectrum Protect, Veritas NetBackup and Oracle Recovery Manager (RMAN), have similar NetApp integration features, along with support for AVA backup repositories. Where possible, backup software quiesces the application, requests a NetApp snapshot of its data and then reads, indexes, catalogs and copies the NetApp backup data to the local AVA. The local AVA then replicates the backup data to cloud storage, also keeping a local copy for fast restores. Restores reverse this process, with data being retrieved from the cloud or a local AVA disk and then restored to service on NetApp storage. Backups and restores are orchestrated by IT's data protection software, which uses NetApp storage, NetApp software and the AVA to protect application data.

Summary

NetApp hybrid cloud solutions provide a simple way to incorporate cloud storage into their on-premises environment. NetApp storage and AVA solutions enable data to be backed up and restored using on-premises and deep cloud storage repositories. For DR, business-critical applications can now run with current SnapMirrored data in the cloud using NetApp local storage and NPS services. For Dev/Test/QA/Analytics activities, engineering teams can access recent copies of customer data using local NetApp storage and Cloud ONTAP together with public cloud storage services.

IT organizations that take advantage of NetApp hybrid cloud offerings can provide a deeper data protection repository, a more readily available DR solution and a faster way to supply current customer data for engineering activities. NetApp hybrid cloud solutions enable IT to take advantage of cloud offerings in order to reduce costs and improve services for their users, customers and internal engineering communities.

Silverton Consulting, Inc., is a U.S.-based Storage, Strategy & Systems consulting firm offering products and services to the data storage community.

