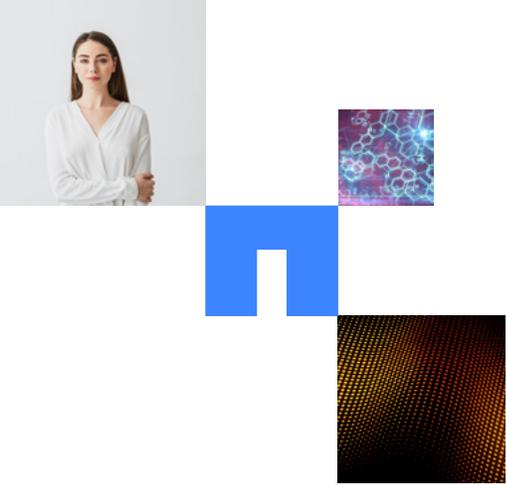


The background of the top half of the page is a dark blue gradient with a bokeh effect of out-of-focus light spots in shades of orange, yellow, and white. A vertical blue light streak runs down the center. On the right side, there is a cluster of overlapping orange squares of various sizes, some of which form a stylized shape resembling the letter 'N'.



Executive Summary

NetApp® ONTAP® data management software has been the mainstay of enterprise data storage for more than two decades. Sophisticated features for data management, space efficiency, replication, and backup have made it a crucial platform for many organizations in the form of physical on-premises appliances. However, with the growing availability of a diverse set of cloud services, including compute, storage, big data analytics, database services, and much more, customers are looking to create heterogeneous environments that can leverage these capabilities. After starting to do this, they quickly discover the disparity in storage and data management available on the cloud when compared to their NetApp systems.

By making use of native cloud compute and storage resources, NetApp Cloud Volumes ONTAP provides a virtual NetApp appliance that works on Amazon Web Services (AWS). Cloud Volumes ONTAP opens up a world of new possibilities for both cloud-only and hybrid architecture environments.

In this paper, we present an overview of Cloud Volumes ONTAP for AWS, including deployment and supported features; examine use cases for this proven technology; and demonstrate the breadth of what can now be achieved.

Cloud Volumes ONTAP Overview

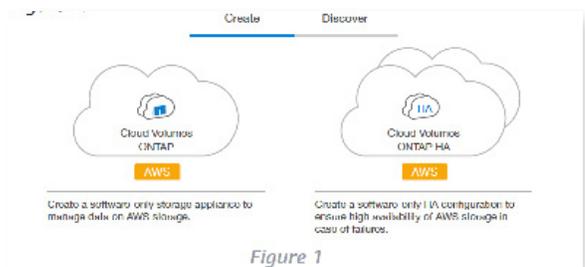
What is Cloud Volumes ONTAP?

Cloud Volumes ONTAP makes use of cloud infrastructure to create a virtual NetApp appliance with all the features of an on-premises system. Amazon Elastic Compute Cloud (Amazon EC2) is used to provide the compute resource necessary to run the Cloud Volumes ONTAP system. Amazon Elastic Block Store (EBS) is the underlying disk layer, and Amazon S3 is used for storage tiering. Amazon EBS volumes come in four different variants and can either be solid-state drive (SSD) based (provisioned IOPS or general purpose) or hard disk drive (HDD) based (throughput optimized or cold). This variety lends itself to the creation of storage tiers, with each tier providing different levels of performance and available capacity.

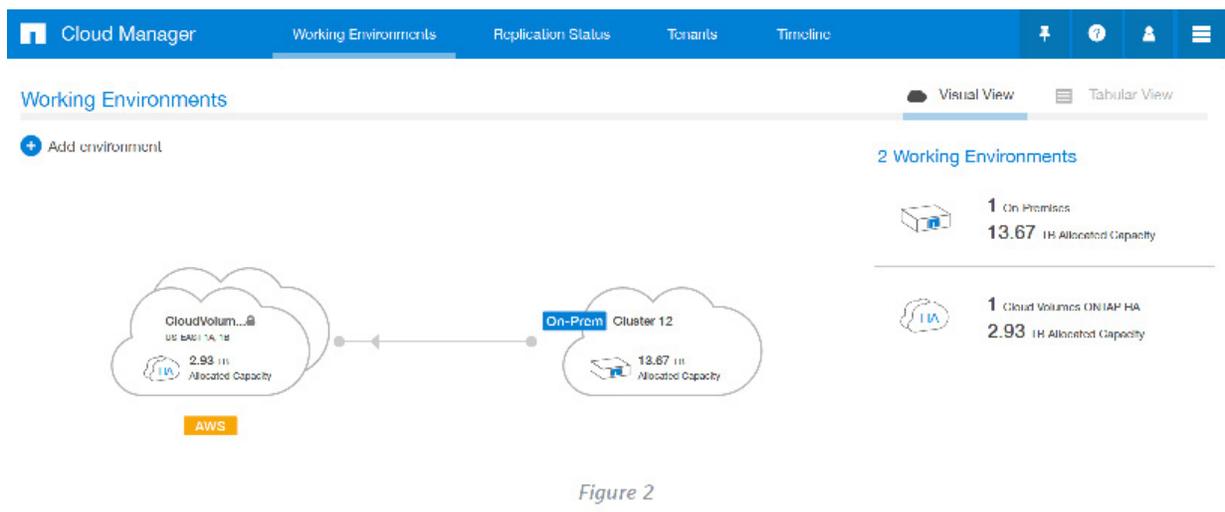
Cloud Volumes ONTAP and ONTAP deployed on-premises use the same operating system, allowing them to seamlessly integrate. For example, SnapMirror® can be used to efficiently and incrementally to replicate data from an on-premises system to Cloud Volumes ONTAP, which greatly simplifies the challenge of getting data into or out of the cloud. NetApp storage administrators find themselves in familiar territory when using Cloud Volumes ONTAP, from the perspective of both the suite of existing NetApp tools and the command-line interface.

How is Cloud Volumes ONTAP deployed?

Cloud Volumes ONTAP is deployed using Cloud Manager, available in AWS Marketplace. Cloud Manager provides a web-based UI used to manage both Cloud Volumes ONTAP and on-premises resources. An intuitive and easy-to-use interface guides you through the process of creating new instances of Cloud Volumes ONTAP, including the provisioning of all cloud resources, system configuration, volume creation, and license selection. See Figure 1.



Cloud Manager also allows you to discover on-premises systems and to set up SnapMirror replication from those appliances to your new instances of Cloud Volumes ONTAP. Replication becomes a simple click-and-drag process in Cloud Manager, speeding the process of setting up a hybrid architecture environment. If you wish to automate your environment creation and setup you can use Cloud Manager API to do so as well. See Figure 2.



Which features of the ONTAP data management software does Cloud Volumes ONTAP support?

Cloud Volumes ONTAP supports the full feature set of ONTAP:



Storage efficiencies.

With support for thin provisioning, deduplication, data compression, and inline data compaction, Cloud Volumes ONTAP helps you consume far less storage capacity than you would by using cloud storage directly, thus saving you a great deal on your in-cloud storage spend.



File sharing services.

Cloud Volumes ONTAP supports all versions of NFS and SMB, allowing you to manage file shares using whichever system best suits your operating environment. The SMB implementation fully supports Active Directory authentication for users and groups, a feature that is not provided natively on the cloud.



iSCSI storage allocation.

Block-level storage allocations to Amazon EC2 instances can be managed as they would normally in an onpremises environment. Storage from different tiers can be allocated as required, which ensures the most appropriate use of storage resources in a centrally managed manner.



Snapshots™ and FlexClone®.

With ONTAP, every Snapshot™ copy only consumes space for data changes. No extra capacity is required. ONTAP Snapshot copies also form the basis for more advanced features, such as FlexClone®, which allows you to instantly create writable clones of existing storage volumes, almost like a writable Snapshot copy that also consumes no extra storage capacity.

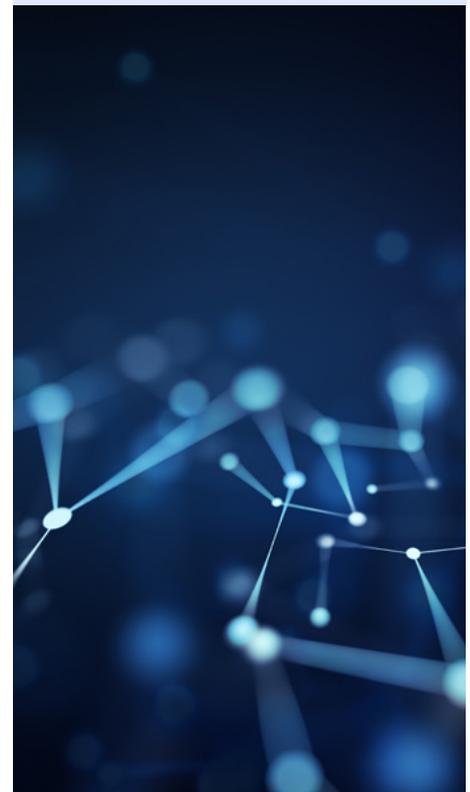


Data replication and backup.

SnapMirror provides enterprise-grade data replication and can be used to incrementally synchronize onpremises appliances with Cloud Volumes ONTAP. SnapVault® can be used with Cloud Volumes ONTAP to create a cloud-based backup solution. SnapMirror can also make it very easy and efficient to replicate data from the cloud back to an on-premises environment.

COST BENEFITS

Through the use of the multiple storage efficiency features just outlined, Cloud Volumes ONTAP can dramatically reduce your overall native cloud storage footprint, which has a direct impact on your operating costs. If temporary copies of data are required, such as for DevOps, dev/test, or ad-hoc environments, the benefits of FlexClone are unparalleled in terms of efficiency, speed of creation, and time to market.



Use Cases

See how Cloud Volumes ONTAP can be used in a number of practical applications.



Cloud Disaster Recovery (DR) and Cloud Backup

Being able to recover from a sitewide failure is a top priority for system administrators. Putting together such a capability usually requires a coordinated effort across various teams, such as storage, networking, systems administration, project management, and so on, as well as the installation of physical equipment at a secondary location. Additionally, many organizations have a requirement for off-site backups.

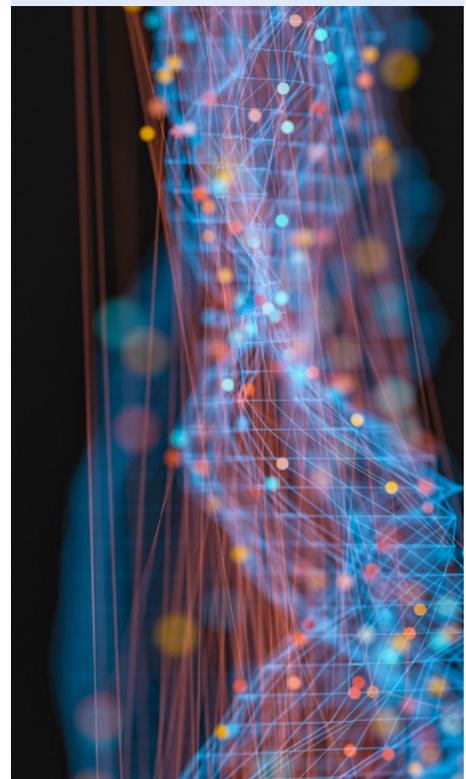
Deploying Cloud Volumes ONTAP can help dramatically simplify the solution implementation for both of these requirements. Cloud resources mean that physical infrastructure does not need to be procured, installed, and then managed directly, which eliminates a large part of the effort required to set up a DR site in the first place. Your data management resources can be allocated as required through Cloud Manager.

For DR, you can use SnapMirror for data replication between on-premises systems and Cloud Volumes ONTAP, which can also be facilitated directly from Cloud Manager. While SnapMirror creates an exact replica of your source data on the destination system, SnapVault is available to create copies of your source data with longer retention policies on the destination system to facilitate your cloud backup requirements.

Fabric Pool is another Cloud Volumes ONTAP feature that tiers the Snapshot copies to cost-effective Amazon S3 storage, freeing up the Amazon EBS performance tier for “hot” data. When you replicate a volume to a tiered storage configuration for DR purposes, all data for the destination volume resides in the Amazon S3 capacity tier. The data automatically moves to the Amazon EBS performance tier if you activate the destination volume and access data.

As an example, a NetApp customer in the recruitment industry built out its DR capabilities using Cloud Volumes ONTAP and SnapMirror, enabling the ability to fail over to the cloud in the case of a major systems failure. Cloud Manager is used to administer all of the company’s on-premises and cloud storage environments, including the replication relationships between them. The company also has the ability to scale up when a disaster occurs, moving from cold storage to SSD and from a low-performance to a high-performance Amazon EC2 environment.

Cloud Volumes ONTAP provided the customer with the same features as its physical environment, which meant that the customer got the same benefits for its business.





Production Cloud Environment

Cloud Volumes ONTAP provides a comprehensive data management solution for systems that are fully cloud-based, in the same way as NetApp appliances do for traditional on-premises systems. Centrally-managed, tiered storage can be connected to Amazon EC2 instances over iSCSI. Storage can also be served out to client users and hosts directly from Cloud Volumes ONTAP using either NFS or SMB. Data management features help to minimize your cloud storage footprint and thereby reduce associated costs.

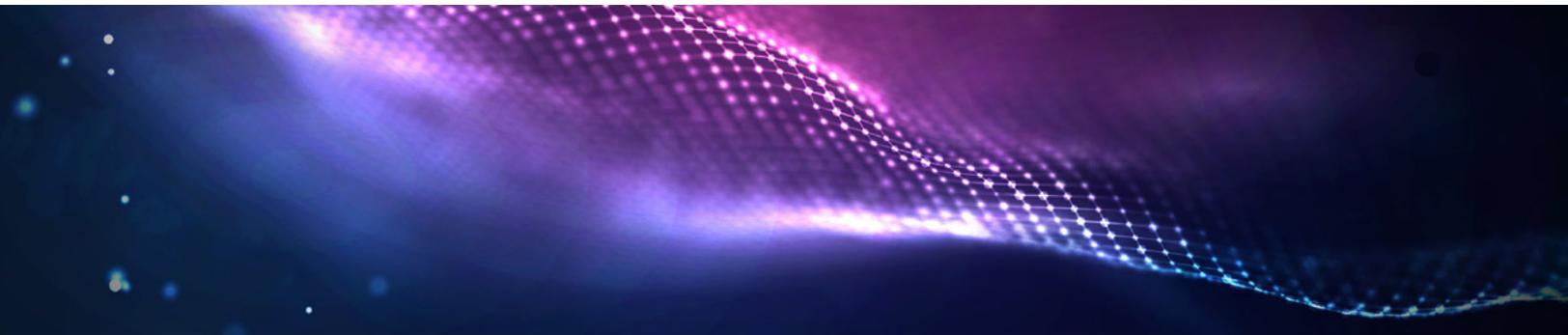
The whole spectrum of proven enterprise features provided by

Cloud Volumes ONTAP can help enterprise organizations use the cloud as their primary platform for cloud data management.

Of the many NetApp customers now using Cloud Volumes ONTAP to host their production systems, one customer in particular needed to migrate its SQL Server-based environment to AWS. Cloud Volumes ONTAP provided the customer with the same features as its physical environment, which meant that the customer got the same benefits for its business. This also simplified the customer's transition to the cloud because existing systems

and applications did not need to be overhauled.

Using the cloud enables this customer to gain greater data protection consistency through the use of Availability Zones as DR regions. NetApp SnapCenter technology gives Cloud Volumes ONTAP the ability to take consistent snapshots. The customer saw a reduction in overall total cost of ownership (TCO), because the majority of the infrastructure usage occurs during business hours. By using Cloud Volumes ONTAP, the customer's staff could be effective immediately without additional training.



File Services Using NFS and SMB

Cloud-based NFS and SMB file shares can be created quickly and easily using Cloud Volumes ONTAP and allow the same file system to be accessed concurrently by many different users and applications for read and write workloads. The cloud is not known for facilitating file services on the cloud with integrated Snapshot capability for backup and recovery. Yet ONTAP is known for that very thing. Because

Cloud Volumes ONTAP is just ONTAP on the cloud, you're able to take advantage of all of the expansive file services capabilities ONTAP offers on the cloud.

Using Cloud Sync, a NetApp Data Fabric solution for incrementally synchronizing data with the cloud, these NFS and SMB file shares can be used to integrate Cloud Volumes ONTAP with Amazon S3. You can expose your file share data to a

wide variety of cloud services including Amazon Elastic MapReduce (EMR), Amazon Elastic Search, Amazon Athena, and custom usage with cloud-native applications. This capability is directly accessible from within Cloud Manager or externally through datafabric.io.



Cloud DevOps: Development and test environments

Software developers frequently require test copies of production data and databases to support their development effort. In most cases, the source data is very large, and the copies need to be writable and recreated quickly. These requirements make traditional methods for replicating data for DevOps and dev/ test inefficient and costly. This is especially apparent when multiple copies are required. See Figure 3.

Because Cloud Volumes ONTAP supports FlexClone, any volume can be cloned instantly and in a constant manner for the point in time that it is taken, regardless of source data size. A copy-on-write mechanism is used to only allocate and write blocks when data actually changes in the clone, which makes ONTAP FlexClone volumes extremely storage efficient. FlexClone, along with other Cloud Manager features, can be accessed programmatically through a RESTful API, which makes it straightforward to integrate with other processes. These properties make FlexClone ideal for DevOps engineers who need to stand up temporary working environments.

One software consultancy firm has used Cloud Volumes ONTAP and FlexClone volumes to create a fast DevOps environment on the cloud. The firm reduced the time it took to copy its data and create new development environments from more than 20 hours to mere minutes. This provided the firm with a huge boost in productivity and time to market as these environments were a prerequisite for its development cycles. FlexClone also helped the firm to drastically lower its overall native cloud storage spending.



Containerization with Docker

Docker containers are used to ensure consistent deployment of application environments. Containers are more lightweight than virtual machines and contain all required dependencies in a single bundle, making them a tool of choice for use on the cloud. In a Cloud Volumes ONTAP environment, customers using Docker can integrate the management ONTAP brings with volumes and FlexClone volumes with their workflow. For this purpose, NetApp provides the nDVP Docker plug-in as an open-source tool called Trident. When using Cloud Volumes ONTAP, this can make it easier to manage storage resources in a containerized environment.

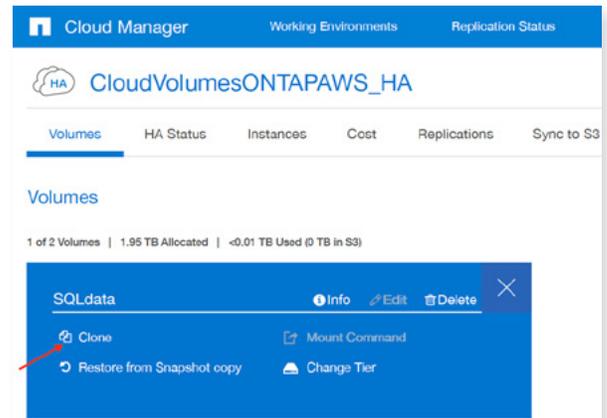
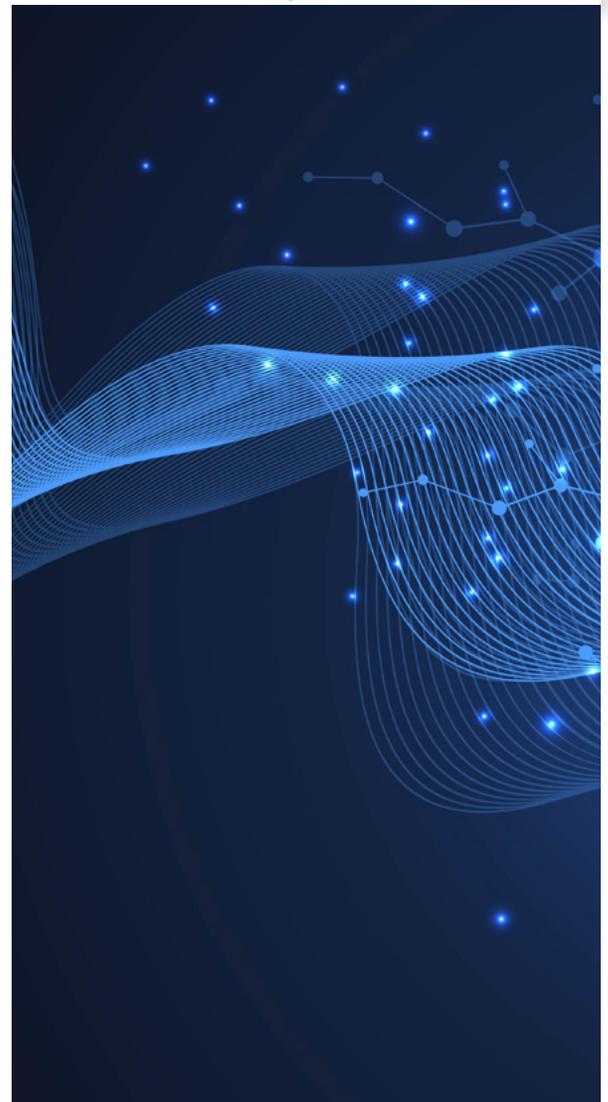


Figure 3



Summary

ONTAP data management software, traditionally used to manage on-premises storage, has matured over its 28-year history and is now designed for enterprise-level data management. Cloud Volumes ONTAP brings the power of this platform to your AWS environment, with all of the necessary tooling for deployment and management provided through Cloud Manager. The ability to use cloud infrastructure alongside on-premises systems opens a wealth of new possibilities and capabilities for your enterprise organization.

Open a wealth of new possibilities and capabilities for
your enterprise organization.

Visit [AWS Marketplace](#) to start a free trial of Cloud Volumes ONTAP.

[Get Started >](#)

Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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