White Paper | Pure CBS on Azure

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Introduction

As the IT industry continues to transform, the public cloud is playing a larger role in most companies' IT infrastructure. The public cloud provides users quick access to compute, network, and storage services. However, due to various factors such as cost, resiliency, efficiency, compliance, and enterprise requirements, companies often find it difficult to fit every application in a single private or public cloud. Therefore, many enterprise companies are seeking a hybrid or multi-cloud strategy where they can leverage both their private cloud and the public cloud to address the diverse demands of their IT infrastructure. To address these demands, Pure Storage has introduced Cloud Block Store to help customers with their transformation into a hybrid or multi-cloud world. Pure Storage's Cloud Block Store is a software defined storage solution that leverages the native storage resources of the public cloud to provide an enhanced storage service with enterprise features. Cloud Block Store addresses the fundamental challenges companies face when looking to use the public cloud.

With a hybrid or multi-cloud strategy, developers gain the flexibility and freedom to navigate and circumvent the potential limitations of a single private or public cloud. Organizations would be able to run in the environment that suits each of their unique applications. Users may want to copy or migrate data between their private and public cloud environments as their environment changes over time. However, private and public cloud environments have unique services, APIs, cost models, performance characteristics, management tools, and architectures. Therefore it can be challenging to run identical applications between two different private or public clouds.

Cloud Block Store solves these problems by providing a common data services layer. The common data services layer provides consistency in storage services across heterogeneous private and public clouds. Developers can redeploy their applications across any environment without the need to refactor, redesign, or re-architect their applications. While based on the Purity Operating Environment of the FlashArray, Pure Storage refactored Cloud Block Store to run in both Microsoft Azure's public cloud and Amazon Web Services (AWS). Cloud Block Store provides industrial-strength block storage with the same industry-leading features and benefits of the FlashArray. The following are the key features and benefits of Cloud Block Store:

Simplicity
By using Azure managed applications, customers easily deploy a Cloud Block Store managed application into their desired VNet in a few minutes. Cloud Block Store offers the same simplicity and user experience that all FlashArray customers appreciate. There are no RAID pools or manual data tiering required. Once iSCSI connections between Azure VM hosts and the Cloud Block Store managed application are established, customers can easily create and mount Cloud Block Store volumes to the desired Azure VMs in seconds using the same GUI, CLI, or APIs as the FlashArray.

Industry-leading data reduction services
The Purity Operating Environment helps customers reduce the underlying cloud storage resources required to house their data. Data is deduplicated in-line and compressed before landing on the underlying storage resources, ultimately reducing storage costs. Thin Provisioning, which is a significant differentiator compared to the public cloud's block storage, allows developers to freely overprovision volumes without the associated

costs. Since only unique data blocks that are written by the host application would consume storage resources, thin provisioning truly provides the "set-it-and-forget-it" experience. Also, customers benefit from instantaneous snapshots and clones, which are pointer-based and consequently do not consume additional storage. Imagine the ability to take thousands of snapshots and clones without incurring additional costs.

Resiliency
When customers deploy mission-critical applications, they must ensure that their applications are resilient against single points of failure (SPOF). To protect against SPOF with native Azure disks, applications must mirror their data across one or more disks, which effectively increases the storage consumption. Cloud Block Store offers built-in protection against multiple concurrent backend storage failures using RAID-HA. A Cloud Block Store managed application can sustain two concurrent backend disk failures and continue to serve data unaffected. For the ultimate level of data protection and business continuity, customers can replicate data between AZs or regions.

APIs
When moving data to and from the public cloud, developers must redesign their applications to use different APIs between the various cloud environments, which is a major obstacle. However, with a common underlying storage services layer, developers can continue to use the same APIs, orchestration tools, and operational workflows whether they use the FlashArray on-premises, Cloud Block Store on AWS, or Cloud Block Store on Azure. Documentation for API Tools can be found on GitHub.

Mobility

With the native replication features of Cloud Block Store, customers can easily copy or move data for purposes such as disaster recovery, migration, test/development, and backup. It is important to emphasize that data mobility is not just about moving data. It is also about minimizing the effort to change the applications or workflows between different private or public cloud environments. Customers can access and manage their data the same way between their on-premises FlashArray or with Cloud Block Store.

Furthermore, the CloudSnap feature, available on both FlashArray and Cloud Block Store, offers an additional low-cost alternative to back up, copy, or move data to the public cloud.

Enterprise Capabilities
Cloud Block Store provides enterprise features that customers expect in their evolving IT environment. These features include data reduction services, instantaneous snapshot creation/restores, always-on encryption, QoS, asynchronous replication, and Purity ActiveCluster synchronous replication.
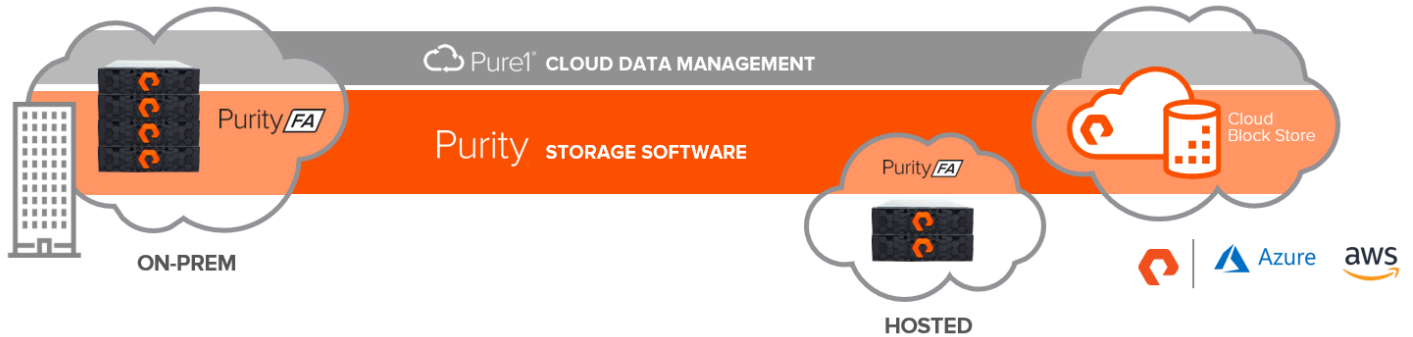
Pure Cloud Block Store Architecture and Core Components for Azure

Cloud Block Store uses the existing Purity Operating Environment to deliver the enterprise features and efficiencies available on the FlashArray. Also, it is important to emphasize that the deliberate architecture of Cloud Block Store provides superior resiliency and consistent performance compared to other third-party storage vendors deployed in the public cloud.

Controllers
The Purity Operating Environment (POE) runs on the Cloud Block Store controllers, which consist of two Azure VMs. The dual controllers ensure high data accessibility and availability in the event of a single controller (Azure VM) failure. iSCSI connections can receive and transmit IO traffic through both controllers. The Cloud Block Store controllers process the data (deduplicate, compress, and encrypt) before writing to the underlying storage resources.

Read Cache
Each Cloud Block Store controller VM comes with high speed temporary storage. This temp storage accelerates read performance which can be beneficial for various datasets with recurring read workloads.

NVRAM
Cloud Block Store uses high-performance Azure Managed Disks as the NVRAM modules. All host write IOs are initially cached onto the NVRAM modules and immediately acknowledged back to the application host after it has been securely written.

Persistent Storage
The backend persistent storage consists of 14 Azure Managed Disks. After a host IO is securely written onto the NVRAM modules, data is eventually flushed and striped across the 14 Managed

Disks. For host reads, if the requested dataset does not reside in the read cache, it will be read directly from the backend Managed Disks. Azure's Managed Disks durability coupled with Cloud Block Store's RAID-HA protection provides a solution for the most mission critical applications.

CosmosDB

CosmosDB is used to store metadata and configuration information about a Cloud Block Store instance. Customer data is not stored on CosmosDB. Only the Cloud Block Store managed app can communicate with CosmosDB account to access the stored metadata.

KeyVault

Cloud Block Store performs in-line encryption prior to persisting data to the backend storage. To perform the encryption, it uses an internal data encryption key that is generated when the Cloud Block Store managed app is initially deployed. To increase security, the data encryption key itself is also encrypted using a customer managed key which is generated and managed by Azure Key Vault. Interaction between the Cloud Block Store instance and Key Vault only occurs during the initial deployment of a Cloud Block Store managed app or when a Cloud Block Store controllers boots up. Key Vault is never in the data path. In addition, since Cloud Block Store is a managed app, users do not have access to the customer managed key within Key Vault. Only the Cloud Block Store managed app can communicate with Key Vault to access the customer managed key.
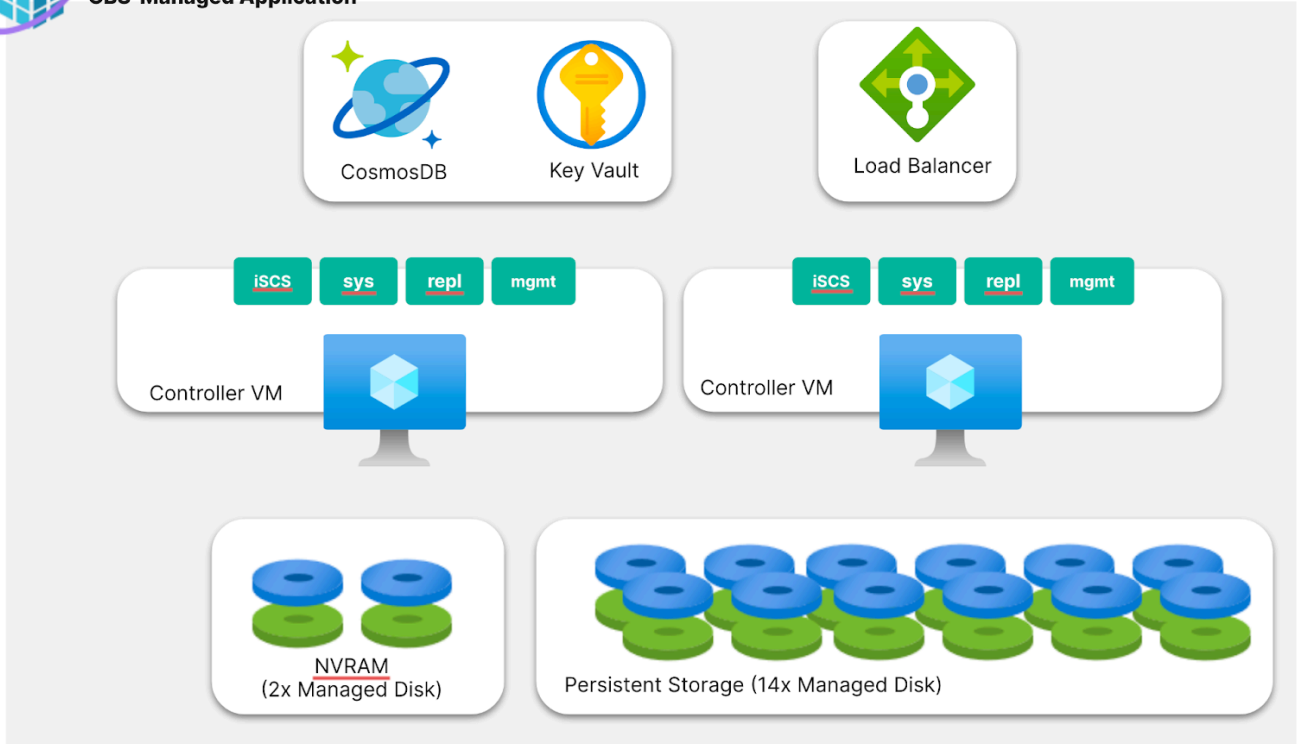
Load Balancer

The internal Azure Load Balancer is fronting both Controller VMs management network interface, serving the management traffic to one floating IP that redirect the requests to the primary controller. Detecting the status of which management endpoint is the primary is achieved by leveraging health probes rules.

CBS Managed Application

CosmosDB | Key Vault | Load Balancer

iSCS | sys | repl | mgmt
Controller VM

iSCS | sys | repl | mgmt
Controller VM

NVRAM
(2x Managed Disk)

Persistent Storage (14x Managed Disk)

Use Cases

Cloud Block Store addresses multiple use cases that help customers enhance their existing storage capabilities.

Production

Application Migration

When migrating data to the public cloud, the requirement to redesign existing applications deployed on-premises is a common challenge. The enterprise data storage services of Cloud Block Store allow customers to easily migrate and run their existing mission critical data in the public cloud without redesigning their applications. Cloud Block Store shares a common abstraction layer as the FlashArray for both management and data access which allows customers to preserve the same operational workflows, scripts, and orchestration tools. Cloud Block Store's built-in resiliency allows for the most mission critical data to run without requiring the application layer to manage data availability.

Existing developers who have standardized on the rich APIs provided by the FlashArray can continue to use them for Cloud Block Store. The identical scripts and automation tools built on the APIs can be directly applied to Cloud Block Store with little or no change. Once again, this workflow reduces the friction for customers who want to migrate their application data between their private and public cloud environments.

Reduce Storage Costs

Once customers successfully make the transition to Azure with Cloud Block Store, they can realize the benefits of Cloud Block Store enterprise features. Customers can consolidate data onto Cloud Block Store to take advantage of Purity's data reduction capabilities. Existing FlashArray customers can expect the same data reduction ratio already observed on their physical FlashArray. Thin Provisioning with Cloud Block Store further improves a customer's total efficiency. Developers can confidently provision volumes as large as needed without the cost concern or the need to constantly resize their disks.

Increase Availability

In production environments, data availability and protection is the number one priority. Customers can rely on the highly efficient snapshot capabilities of Cloud Block Store to provide periodic point-in-time volume snapshots to protect from unintentional data changes. Additionally, customers who require the highest form of data availability can replicate their data between availability zones or regions. ActiveCluster allows data to be synchronously replicated between Cloud Block Store instances in different availability zones. This feature allows for automatic and transparent application failovers in the event of a complete outage of an availability zone. For larger-scale regional outage protection, data can also be replicated asynchronously between multiple Cloud Block Store instances residing in different regions. Lastly, customers can also leverage Purity's CloudSnap feature to send volume snapshots directly to Azure blob store for backup purposes. Customers can restore CloudSnap snapshots to any FlashArray or to other Cloud Block Store managed applications.

Dev/Test

Most dev/test environments rely on the usage of snapshots for their applications. For example, when developers want to test their new code or script against production data, rather than testing against live data, they typically perform their tests on copies of the original data. In the public cloud, developers can make copies using cloud-native snapshot tools. However, depending on the public cloud vendor, these snapshots would incur a charge for the saved data. Furthermore, accessing a snapshot requires a restore process first, which essentially creates a full clone of the desired snapshot. These clones are the equivalent of a fully provisioned Azure disk and customers are charged as such.

Production and Dev/Test in Cloud

Using Cloud Block Store's native snapshot capability in a dev/test environment provides a more streamline and economical option than using the cloud-native snapshot and cloning tools. Customers can run production applications on Cloud Block Store while also generating copies of their production data for development, testing, and analytical purposes. Since Cloud Block Store's snapshots are metadata pointers to the original data, developers can virtually create thousands of snapshots or clones instantaneously while consuming no additional storage. Physical storage is only consumed when there is new and unique data written to the Cloud Block Store volumes. These capabilities improve both efficiency and operational workflow for a dev/test environment.

Production and Dev/Test with Hybrid/Multi-Cloud

Many customers have a desire to separate their production and dev/test environments. They may want to keep their production data in their private cloud while leveraging the public cloud's elastic compute capabilities to spin up dev/test environments on demand. Cloud Block Store allows this type of workflow. Customers can run their mission critical production workload on a physical FlashArray while replicating the same dataset onto a Cloud Block Store managed application. As the need arises, they can spin up their Azure VMs on demand and start testing, development, or analysis of their data on Cloud Block Store. Any scripts or API's used on the FlashArray can be reused for Cloud Block Store. When they're done, they can shut down the Azure VM to reduce costs. If the dataset is no longer needed, they can even remove the Cloud Block Store managed application and redeploy the next time it is needed.
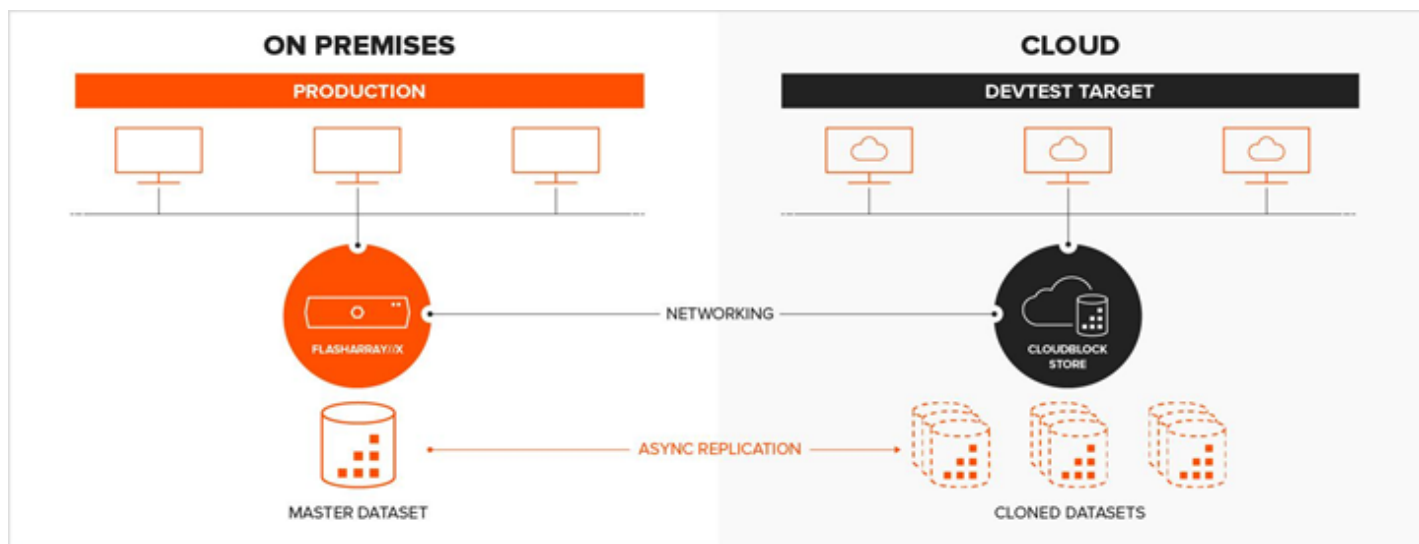
Replication

Array-based replication allows customers to efficiently copy or migrate data between Cloud Block Store managed apps and physical FlashArrays (or other Cloud Block Store managed apps). Cloud Block Store supports bi-directional asynchronous replication between Cloud Block Store managed apps and FlashArrays. Cloud Block Store also supports synchronous replication using ActiveCluster between two Cloud Block Store managed apps. Various supported topologies include one-to-many, many-to-one, and Active/Active Async topologies.

Leveraging the same robust Purity Operating Environment as the FlashArray, Cloud Block Store provides a proven, highly efficient, and rich replication solution. Not only can customers reduce the underlying storage footprint of their existing data, they can also reduce the amount of data sent across the wire. Data is always deduplicated and compressed prior to replication. Additionally, metadata is continuously shared between replicating parties, which prevents data from being replicated if the blocks already exist on the target. These built-in efficiencies reduce the overall time, bandwidth, and potential egress cost associated with replicating data.

Customers can replicate data between FlashArrays and Cloud Block Store managed apps as long as there is network connectivity between the two appliances. A Site-to-Site connection or an Azure ExpressRoute is commonly used to connect between a VNet and customer's datacenter. For customers who want to connect two Cloud Block Store managed apps that reside in separate VNets or regions, Azure virtual network peering can be used.

The replication workflow is identical to existing steps on the FlashArray. Customers can use protection groups (pgroups) to asynchronously replicate groups of interdependent volumes consistently. Customers can also synchronously replicate volume(s) using stretched pods with ActiveCluster. There are no requirements to learn new procedures or change operational workflows when replicating with Cloud Block Store. And to reduce the overall failover RTO, customers can use the same existing Purity REST APIs to streamline and automate the failover workflow.
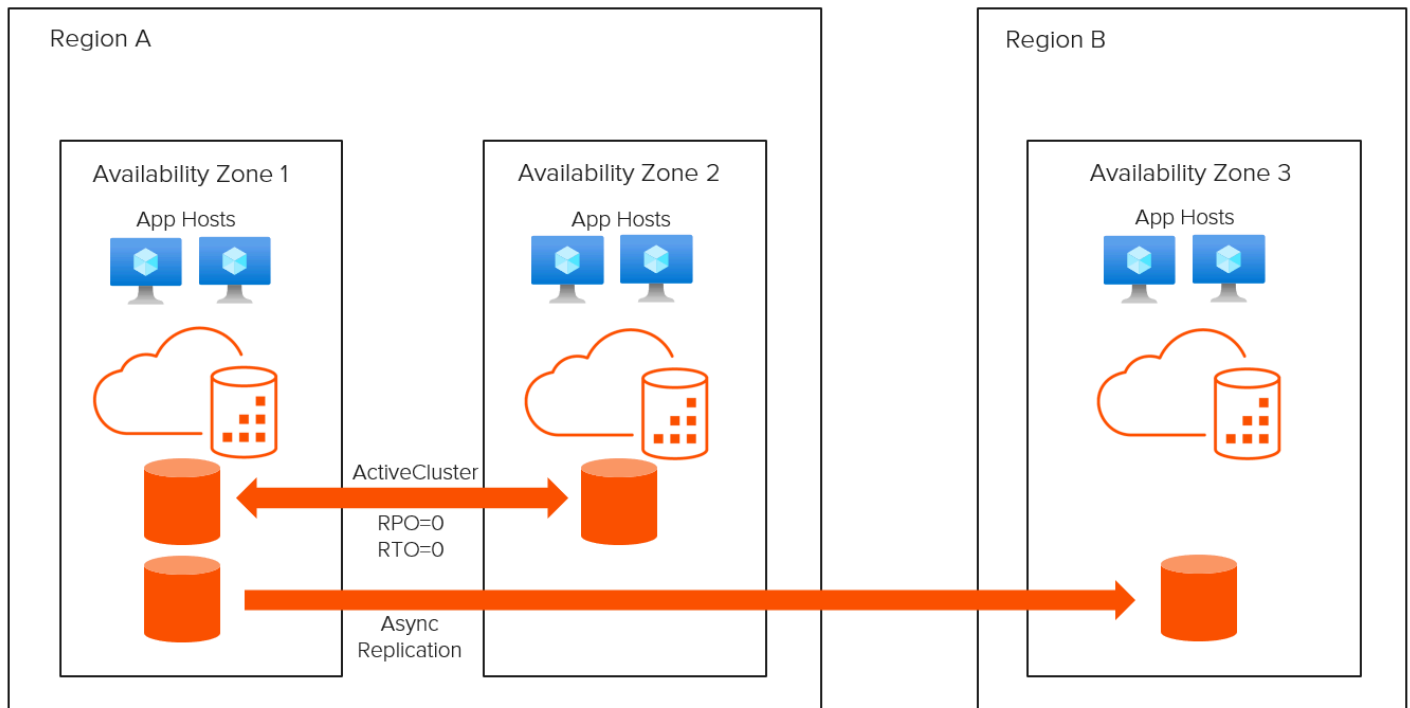

Disaster Recovery and Migration

The Purity Operating Environment enables both the FlashArray and Cloud Block Store to use the same proven replication technology despite running on two different environments. This feature opens the door to use cases including disaster recovery, data migration, and back-up to the public cloud.

For disaster recovery (DR) solutions, many customers search for ways to incorporate the public cloud. Leveraging the public cloud alleviates the need to manage remote secondary or tertiary physical data centers. In a disaster recovery solution, customers can use Cloud Block Store as a replication target. During a DR failover event, customers can use a replicated snapshot volume on Cloud Block Store to instantaneously clone and attach to the respective application hosts in the public cloud. For protection against a single AZ or regional failure, a Cloud Block Store managed application can replicate its own source volumes to other Cloud Block Store managed applications.

Customers looking to migrate data from their on-premises data center to the public cloud can rely on Cloud Block Store to not only provide the vehicle to move their data, but also provide ongoing enhanced data services. Once data volumes are replicated to Cloud Block Store, customers can easily attach the volumes to the application VMs over iSCSI with the same simple steps as on a FlashArray.
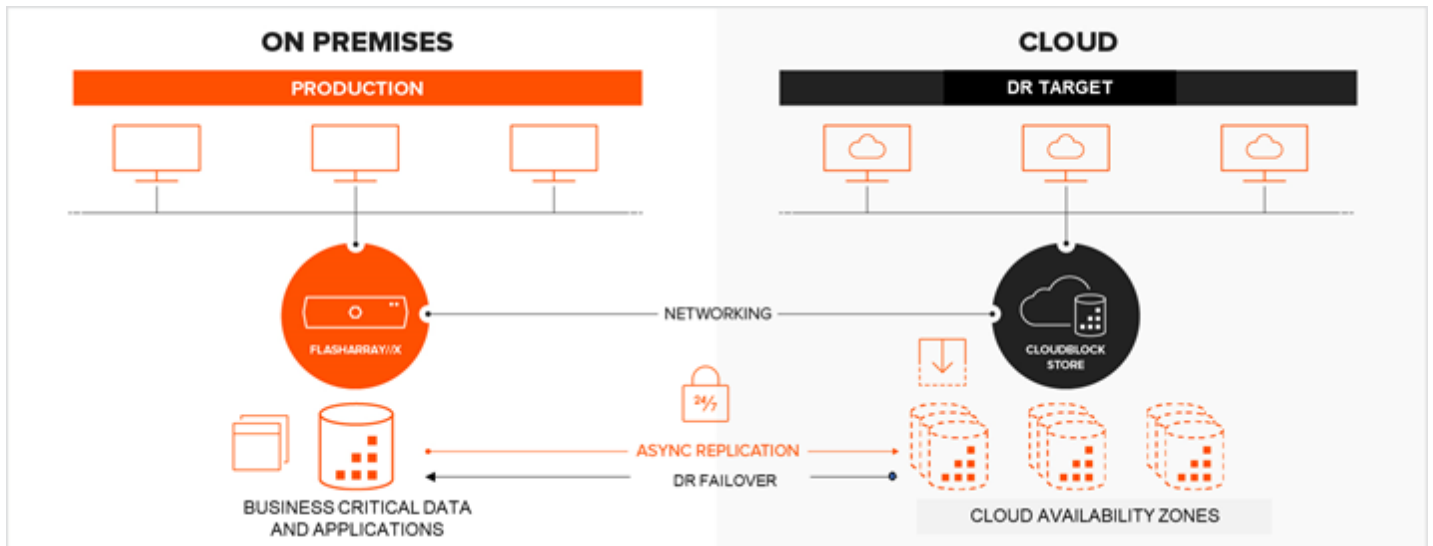

Snapshot Offload with Purity CloudSnap

CloudSnap is a built-in feature that allows customers to quickly send snapshot copies of their FlashArray or Cloud Block Store volumes to cloud targets like Azure Blob storage or Amazon S3 buckets. These snapshots are self-contained with the meta-data needed to restore volumes back onto any other FlashArray or Cloud Block Store deployment. CloudSnap is built for archival and backup/restore purposes, but can potentially be leveraged as a DR alternative for customers who have higher RTO/RPO tolerances. For example, customers can periodically send CloudSnap snapshots to Azure Blob storage. In a DR event where the primary site is inaccessible, customers can deploy a new Cloud Block Store managed application on-demand and restore their CloudSnap snapshots. Once the CloudSnap snapshots are fully restored onto the Cloud Block Store managed application, customers can attach the restored volumes to the appropriate Azure VMs in their VNET to resume application services. This DR alternative provides a lower cost option for customers who have a higher RTO/RPO tolerance. Since volumes can be restored from Azure Blob storage or Amazon S3, the RTO will largely depend on the amount of data that has to be restored.

Hybrid and Multi-Cloud

Cloud Block Store provides an abstraction layer that allows application storage architecture to be agnostic to the private or public cloud that it runs on. This enables customers to seamlessly move their data between Azure, AWS, or their own private cloud using the native replication capabilities of Cloud Block Store. Furthermore, Cloud Block Store's data reduction is preserved when data is replicated, thus reducing the required bandwidth, time, and potential data egress costs. Customers are protected from being locked into any single environment and are afforded the flexibility to migrate or replicate data with minimal effort.
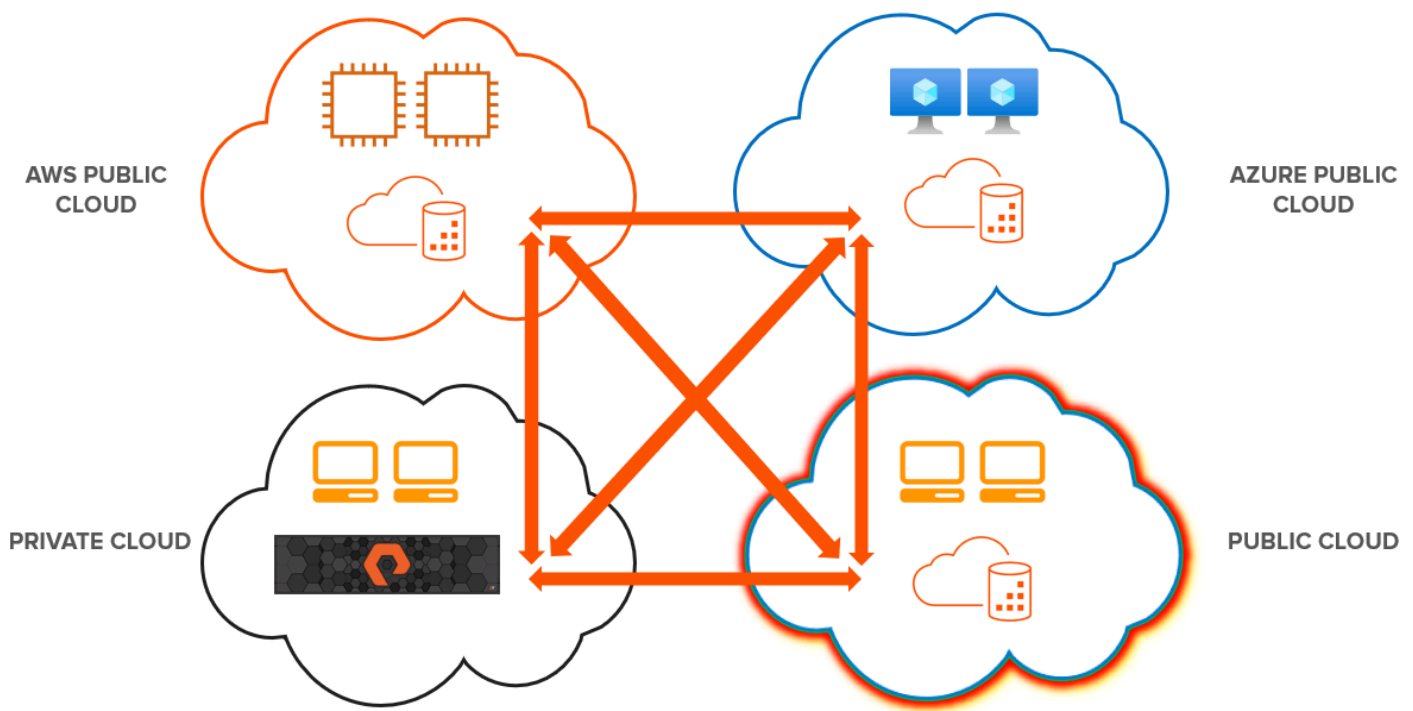
VMware Environments

Azure VMware Solutions

Customers who deploy Azure VMware Solution (AVS) can now take advantage of Pure Cloud Block Store. Cloud Block Store allows customers to expand their AVS VM's storage capacity independently from the AVS nodes, providing an economical storage option. There are three main point why would customers use the Azure VMware Solution powered with Pure Cloud Block Store:

Fast-tracking the Path to ROI: For all customers, the ability to use Pure Cloud Block Store block storage allows for right-sizing your storage to better match storage purchase to consumption. This can significantly reduce the overall cost of AVS at scale, speeding up the time to ROI and allowing for more workloads to be migrated to the cloud or redirecting spend to service (e.g., SQL as a service).

Simpler Migration with Proven Tools: Use familiar tools to migrate. Use VMware's suite of migration tools to move your workloads to AVS. On-premises FlashArray customers have the additional benefit of being able to use all of the data services of Purity to replicate data easily to AVS. Data on Pure Cloud Block Store volumes are in the Purity Operating Environment and have all of the and fully interoperate.

Securing Your Destination for You: Up-front investments aren't just costs. There's also the investment in processes and security. All the storage management tools and data protection features of Purity are available and free. One important feature is Auto-on SafeMode™, which delivers ransomware protections by default when new volumes are created, automatically. This frees up your time to evaluate app modernization for your legacy workloads with Azure data services as you integrate the cloud as part of your larger infrastructure strategy.
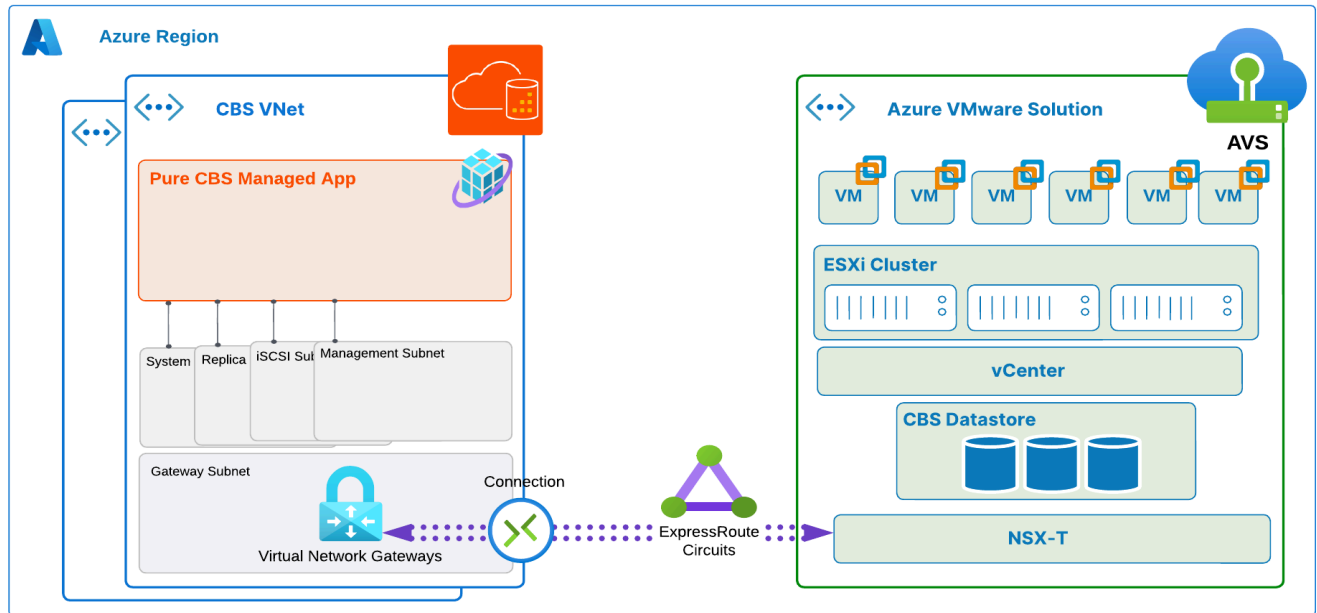
Data Mobility using vVols

Undoubtedly, VMware is a dominant presence in the IT industry. As architectures shift and transform to encompass a hybrid cloud model, data mobility for guest VMs is crucial. However, Azure does not natively support VMFS file systems, so a VMFS volume that is replicated to Azure is not readable by the Azure provided VMs. Storage vMotion provides a simple solution for customers, allowing them to convert their VMFS datastore-based VMs into distinct VMware vSphere Virtual Volumes (vVols)-based VMs. Each vVol is a standalone volume that is formatted with the respective file system of the guest OS. Therefore, a vVol from a Windows guest VM is directly readable from an Azure VM since it is simply reading an NTFS file system.
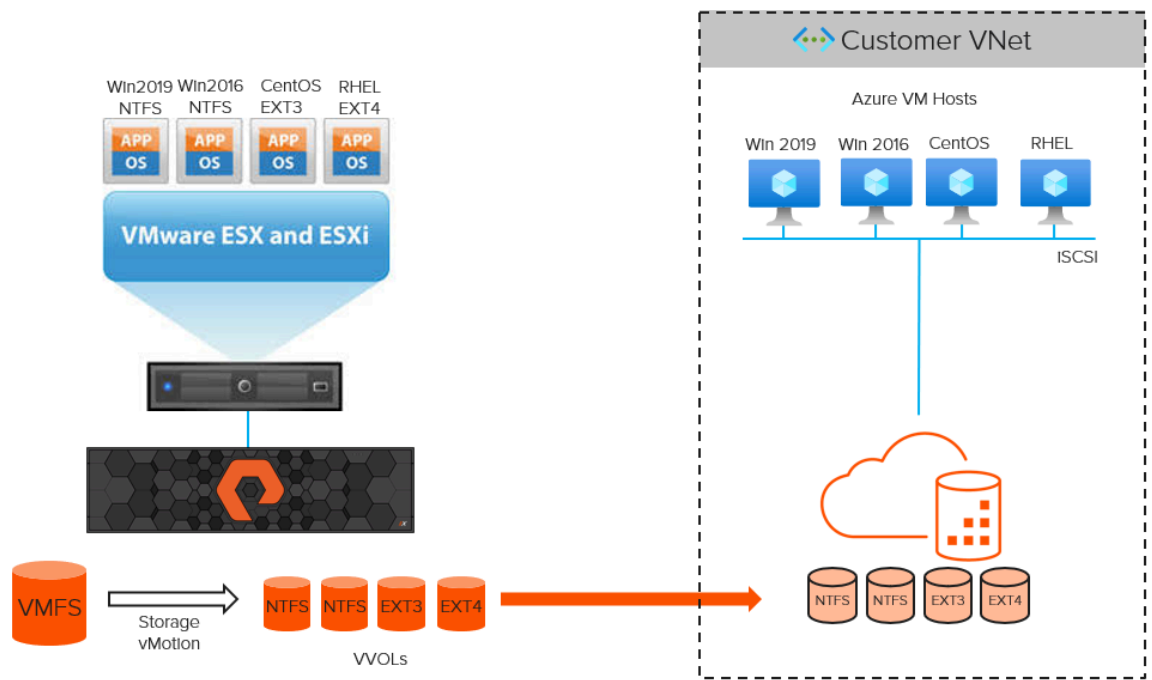
Oracle, SAP HANA, SQL Server and Other Database Environments

Azure provides native snapshot capabilities that are useful when creating backups of Azure disks. This function is adequate for basic backup/restore use cases. But for many dev/test database environments, it can be expensive when there are dozens of cloned copies. More specifically, many developers rely on databases to test against their scripts, applications, or analytics engines. Performing these tests on live production databases is not an option. Therefore, snapshots and clones are essential for many developers. Cloud Block Store allows developers to instantaneously create snapshot copies and clones of production databases. The data reduction engine of Cloud Block Store reduces the overall costs of creating the database snapshots and clones since only new and unique blocks of data consume additional storage space. Customers can potentially create hundreds of snapshots and clones without consuming any storage or incurring any additional costs.

Non-Disruptive Upgrades (NDU)

As new Purity software code or next-generation hardware becomes available, Pure's FlashArray facilitates effortless non-disruptive in-place upgrading. Customers who consume services from the public cloud expect minimal intervention experience. Cloud Block Store follows these principles and provides non-disruptive upgrades (NDU) for capacity increases and new Purity code releases. When an NDU is needed, Pure Support will request secure access to the Cloud Block Store managed application using Azure's just-in-time (JIT) feature. Once granted, Pure Support will remotely execute internal scripts to automate the upgrade process. Since Cloud Block Store is fully redundant, customers do not need to perform manual failovers and failbacks. Cloud Block Store data services remain online, and the data is accessible for the duration of the upgrade.

Procurement and Deployment

Procurement

Pure Storage provides two flexible options to obtain a Pure as-a-Service subscription, which will allow customers to deploy and consume Cloud Block Store capacity. Partners are given credits for either option that their customers choose to procure a Pure as-a-Service subscription.

Pure-as-a-Service via Pure
Customers can work with Pure Storage partners to obtain a Pure-as-a-Service subscription contract. The subscription contract includes a Cloud Block Store license key that allows customers to deploy Cloud Block Store in any desired Azure subscription(s). This option requires a minimum 1 year contract but is the most economical option.
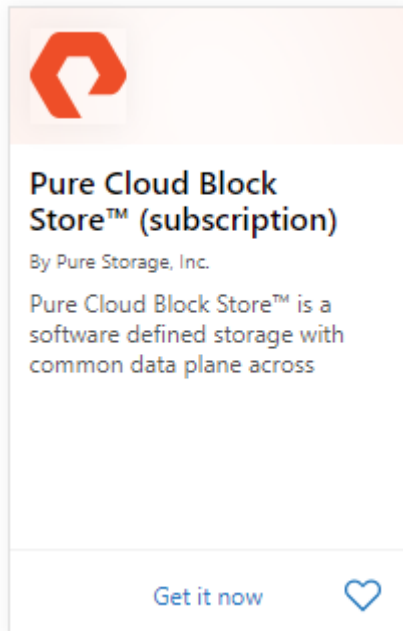
Pure-as-a-Service via Azure Marketplace
Customers who do not prefer long-term contracts or have pre-committed spending with Azure can go directly to the Azure Marketplace and obtain a Pure-as-a-Service subscription + Cloud Block Store license key. This license key allows customers to deploy and use Cloud Block Store in any desired Azure subscription(s). Customers who start with this short-term contract have the option to migrate to a longer term Pure as-a-Service contract if desired.

Search *Cloud Block Store* in the Azure Marketplace, or click here to view the listing.

Deployment

Customers can deploy Cloud Block Store in a few simple steps. Whether customers obtained the Cloud Block Store license key through Pure as-a-Service or the Azure Marketplace, steps to deploy Cloud Block Store are identical. Deployments can start from the Azure Marketplace where customers can select the *Cloud Block Store Product Deployment* listing. The product deployment listing will walk customers though selecting their desired parameters. The deployment is completely automated and results in a fully initialized Cloud Block Store managed application. See the Cloud Block Store Deployment and Configuration Guide for detailed deployment steps and prerequisites.

Search *Cloud Block Store* in the Azure Marketplace, or click here to view the listing.