Conceptual TCO: Dell APEX Block Storage for Public Cloud

Silverton Consulting, Inc. StorInt™ Briefing

Executive Summary

Dell Technologies offers several services under the Dell APEX™ umbrella, but this paper will focus primarily on the Dell APEX Storage for Public Cloud offering family, specifically Dell APEX Block Storage for Public Cloud, and Dell APEX Navigator for Multicloud Storage. The paper will compare Dell cloud storage functionality and cost against native cloud options from Amazon and Microsoft.

***Dell APEX Block Storage for Public Cloud** offerings are cloud implementations of software-defined Dell PowerFlex™ storage, which has been a premier block storage offering for almost a decade now and was the second Dell storage offering to be made available in public cloud.[1]*

Dell APEX Block Storage for Public Cloud brings many Dell PowerFlex on-premises features, including linear scaling of performance and capacity, to Amazon Web Services™ (AWS™) and Microsoft® Azure™ cloud environments. Linear scaling of performance and capacity means organizations can start with as few as four nodes and grow to 512 nodes in the cloud. Dell APEX Block Storage for Public Cloud also offers thin provisioning, high data availability, single- and multi-AZ (availability zone) configurations and easy data migration from on-premises to cloud, region to region and one public cloud to another.

The paper will compare the cost of capacity-matched and performance- & capacity-matched Dell APEX Block Storage for AWS configurations using Elastic Block Store (EBS) backed storage and AWS EBS storage-only solutions and show that the Dell solution provides up to an 87% cost saving. Similarly, Dell APEX Block Storage for Microsoft Azure showed up to an 82% cost savings against capacity- and performance-matched Microsoft Azure-managed virtual disk solutions.

In addition, Dell APEX Navigator for Multicloud Storage adds significant deployment, monitoring, management, and mobility automation capabilities to Dell APEX Block Storage for Public Cloud. Accordingly, the paper includes Navigator licensing in all cost comparisons.

Given the total cost of ownership (TCO) advantages plus the functional richness of Dell APEX Block Storage for Public Cloud offerings, it's hard to find any reason to use native public cloud block storage solutions on their own.

[1] *The first Dell storage offering implemented in the cloud was Dell APEX Protection Storage for Public Cloud, a cloud-hosted version of Dell's DDVE based on PowerProtect DD technology.*

Introduction

Today, enterprise data rarely resides in the data center alone. Instead, most enterprises support multicloud IT, providing data processing on-premises, co-located, as well as in private and public clouds.

As organizations move data processing to public cloud, they often need to use high performance block storage to sustain application user experience. But native cloud IO performance surcharges, when added to capacity costs, can quickly add up. Moreover, block storage functionality in the public cloud can also have serious deficiencies, which become more apparent as storage capacities increase over time.

Dell APEX Block Storage for AWS and Dell APEX Block Storage for Microsoft Azure can supply all your block storage requirements for AWS and Microsoft Azure public clouds. Further, Dell APEX Navigator for Multicloud Storage, a deployment, monitoring, management, and mobility solution for Dell APEX Block Storage for Public Cloud is also available.

Dell APEX Navigator for Multicloud Storage

Dell APEX Navigator for Multicloud Storage is a SaaS based application that adds significant management capabilities to Dell APEX Block Storage for Public Cloud offerings. Dell APEX Navigator helps customers run their multicloud environment with streamlined management, accelerated productivity and secure multicloud operations.

Dell APEX Navigator for Multicloud Storage centralizes and secures operations for Dell storage endpoints in the public cloud and includes

- **Deployment -** Dell APEX Navigator for Multicloud Storage simplifies deployment of Dell storage in public cloud, with only four steps 1) select storage solution and cloud; 2) select cloud access; 3) select deployment configuration; and 4) review and deploy. Once done, Navigator configures and deploys all needed cloud infrastructure to bring up the Dell storage solution.
- **Management –** once deployed and operating, Dell APEX Navigator for Multicloud Storage supports a central hub for ongoing management activities using in-context navigation for Dell storage management, consolidating management for all Dell APEX Block Storage for Public Cloud, and mirroring the experience of on-premises.

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- **Monitoring -** Dell APEX Navigator for Multicloud Storage helps organization visualize storage system health, performance, capacity trends, and license inventory which include the use of Dell CloudIQ for on-premises storage.
- **Mobility -** Dell APEX Navigator for Multicloud Storage helps customers optimize data strategy with easy data migration between Dell storage deployed on-premises and in the cloud. Using storage native, journaling replication, organizations can rapidly move data across deployments.

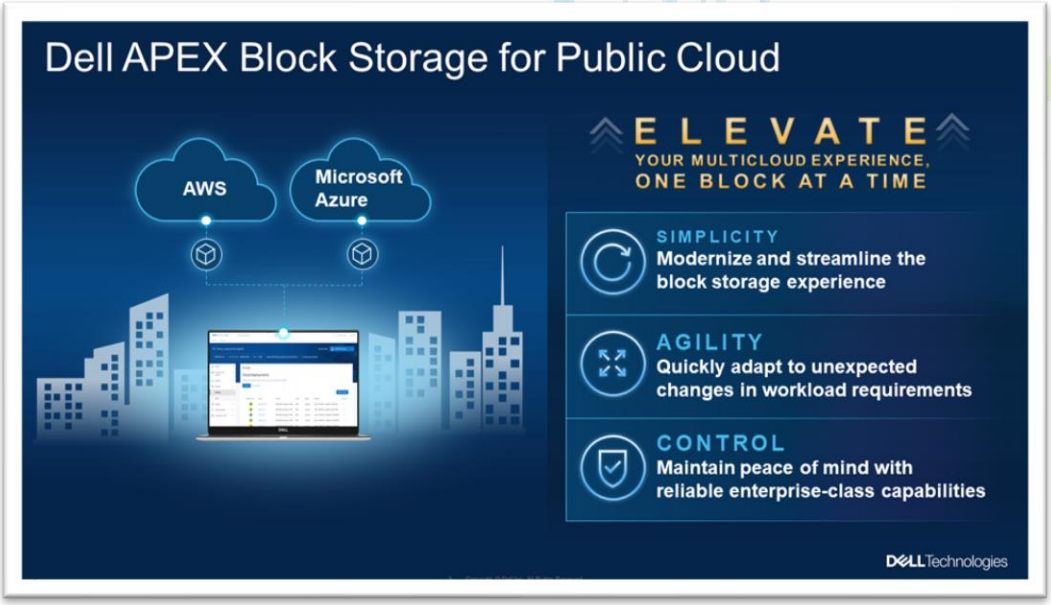
Maintaining secure operations is critical for organizations today. Dell APEX Navigator for Multicloud Storage helps adopt Zero-Trust by including identity and access management services such as federated identity, single-sign on and role-based access control for its features and capabilities.

Furthermore, Dell APEX Navigator for Multicloud Storage supplies an API-first, easy automation path for customers to integrate their preferred cloud automation tools for Dell storage. This includes pre-built Terraform® scripts to help automate management and control of Dell storage in public clouds as well as data mobility.

These capabilities will be available for Dell APEX Block Storage for AWS this year and support for Dell APEX Block Storage for Microsoft Azure will be available in the first half of 2024. As a matter of convenience, we have included Dell APEX Navigator license pricing in all our cost comparisons below.

Dell APEX Block Storage for Public Cloud

Dell APEX Block Storage for Public Cloud is a cloud-hosted version of Dell's software-defined, PowerFlex storage. In commercial use now for almost a decade, PowerFlex was originally designed to operate on just about any X86 server infrastructure with attached storage. From the start, PowerFlex has been able to scale performance and capacity with every node added to its cluster.



Scaling capacity and IO performance together with its multi-OS/multi-hypervisor compatibility has enabled customers to consolidate all block IO workloads onto one PowerFlex storage system. PowerFlex scales up to 512 storage nodes in the cloud or on-premises. Even with just an eight-node AWS cluster, Dell APEX Block Storage for AWS supports almost one million sub-millisecond response time IOPS.

PowerFlex also supports state-of-the-art data availability, which works equally well in on-premises and cloud deployments. If any storage unit or cluster node fails in a single- or multi-availability zone (AZ) deployment, Dell APEX Block Storage for Public Cloud automatically allows continuous ongoing data access.

Below, we will cover these topics in greater details and discuss how Dell APEX Block Storage for Public Cloud compares with native block storage offerings from AWS and Microsoft Azure.

Challenge: Block IO performance

Customer workloads span a wide range of IOPS and latency performance. This variance in IO performance only grows larger in the cloud due to serverless compute and instant infrastructure.

Thus, the need for cloud block storage that can support a wide variety of IO performance is of paramount importance. Dell APEX Block Storage for Public Cloud can be deployed with as few as four nodes and as little as 20TB of storage. As workload grows, customers can add nodes to the cluster, using cloud APIs or instance consoles to increase performance and capacity.

Dell APEX Block Storage for Public Cloud scales performance by optimizing data placement and data path usage across its cluster. For example, with Dell APEX Block Storage for AWS, customers can gain the IO performance of AWS io2 block express storage (up to 256K IOPS/volume) from a Dell APEX Block Storage for AWS configuration using only AWS gp3 storage (16K IOPS/volume).

When adding nodes to the system, Dell APEX Block Storage for Public Cloud automatically adds the raw capacity and new IO performance to the cluster. While there is a cloud cost for the instance and storage, there is no additional charge for its increased performance.

Dell APEX Block Storage for Public Cloud offers significant advantages in IO performance when compared to cloud native solutions:

- **For AWS**, EBS gp3 storage offers limited baseline performance. If customers need more performance, they pay more. Similar performance surcharges are incurred for most other EBS storage options. That is, organizations pay AWS for capacity and then pay more for additional IOPS and bandwidth on a KIOPS and MBPS per month per volume basis. Moreover, as EBS is a volume service, IOPS and MBPS performance is assigned to each volume. Unlike Dell APEX Block Storage for AWS, AWS does not aggregate performance across volumes[2].
- **For Azure**, Microsoft is a bit more generous with their IO performance, which scales for most managed virtual disk types by capacity. However, for Azure ultra disk and premium SSD (v2) managed virtual disk types, IOPS and bandwidth performance are purchased separately. Like AWS, each volume's specific performance and capacity cannot be shared, and offers no aggregation across Azure-managed disks.

[2] AWS does offer RAID 0 which stripes data across multiple EBS volumes, aggregating their performance, but then that is only accessible to a single EC2 instance, or with multi-attach (at additional cost) up to 16 EC2 instances. AWS offers RAID 1, 5 &6 but doesn't recommend them.

Challenge: Block data availability

Data availability provides continued access to data in case of hardware or software failures, and the value to an organization of continued access to data is incalculable. Enterprises have come to expect high data availability at the 5-9s to 6-9s level (99.999% to 99.9999%) from data center storage. However, in the cloud, organizations often settle for less.

Dell APEX Block Storage for Public Cloud offers both single- and multi-AZ deployments. In both deployments, the solution is designed to support 6-9s data availability. That is, customers can deploy Dell APEX Block Storage for AWS over standard AWS SSDs that would offer only 3-9s availability in native configurations, but because they are now behind Dell APEX Block Storage for AWS, the system is designed to provide 6-9's.

With multi-AZ deployments, Dell APEX Block Storage for Public Cloud offers even greater flexibility. When deployed over multiple AZs, an entire AZ can go down and customers can still access their data from the other AZs. Moreover, for multi-AZ deployments, single-AZ capacity is split across three AZs, so no additional storage space is required over a single-AZ configuration.[3]

When comparing Dell APEX Block Storage for Public Cloud data availability with cloud-native offerings, Dell comes out significantly ahead:

- **For AWS**, EBS storage offers data availability that depends on storage type. Data availability can range from 3-9s to 5-9s, but AWS offers no native options that supports or is even designed to support 6-9s data availability. Further, AWS offers something like a multi-AZ capability, but it uses asynchronous replication and, as such, automatically incurs twice the storage capacity of the original storage, always lags updates to the original storage and offers no additional data availability.
- **For Azure**, Microsoft offers more data availability for their storage, specifically, locally Redundant Storage (LRS) and Zone Redundant Storage (ZRS) plus asynchronously replicated versions of these. According to Microsoft, LRS supplies 11-9s of data durability and ZRS, a data durability of 12-9s. It's important to note that data durability is **not** data availability. Microsoft makes no claims regarding LRS or ZRS data availability. That said, LRS is triply redundant and should have similar data availability to Dell APEX Block Storage for Microsoft Azure in a single AZ. Further, as ZRS uses three AZs, it should have similar availability to Dell APEX Block Storage for Microsoft Azure multi-AZ deployments. Note, ZRS costs more ($/GiB) than LRS.

Challenge: Block storage data mobility

The days of sticking with the same data center over the long term are gone. Nowadays, customers operate multicloud and are continuously comparing the costs of on-premises, private and public cloud environments to choose the best near-term option for workload hosting. But because this requires co-hosting application data and it takes substantial time, effort, and cost to move data from one location to another, ease of data migration has become a key factor in storage system selection.

[3] There system does require a modest increase in capacity overhead to support multi-AZ redundancy.

Data mobility is a common challenge for current organizations that have different storage solutions on-premises than in the cloud. While moving TBs of data may be possible, moving PBs of data is another problem altogether. Moreover, automation plays an important role in helping to migrate data between clouds, between regions within clouds and between on-premises and cloud locations.

Dell APEX Block Storage for Public Cloud simplifies data migration from one PowerFlex deployment to another with PowerFlex's async **Software Data Replicator (SDR)**. Although PowerFlex SDR was designed to support data disaster recovery (DR), it can just as easily be used to support data migration between deployments. SDR uses journaling to replicate data. Most asynchronous replication offerings use snapshots but SDR's journaling replication should provide lower recovery times and doesn't suffer throttling from snapshot maximums.

PowerFlex SDR can migrate data between AWS, Microsoft Azure, or any on-premises deployment. It can move data across clouds, across regions within clouds and between on-premises PowerFlex deployments.

When comparing Dell APEX Block Storage for Public Cloud data mobility with cloud-native vendor solutions, the cloud-native solutions fall short:

- **AWS,** as discussed earlier, offers async replication between AZs and regions, using snapshot copying. That is, it copies snapshots to the target location, and then re-hydrates them at the target site. AWS also offers other specialized services for some types of block data, such as DMS for database migration. While async replication is sufficient for copying EBS volume data from one AWS region/AZ to another, the main way AWS moves on-premises data to EBS is by using their **Snow** family of solutions (Snowcone, Snowball and Snowmobile). This involves AWS hardware sent to a data center, copying data to that hardware, shipping that hardware back to AWS and copying data from that hardware to EBS. Aside from AWS's Snow series, customers can manually copy on-premises data to EBS using rsync or CLIs/APIs, a process that is slow and cumbersome.
- **Microsoft Azure**-managed virtual disk async replication is tied to VM DR, meaning a VM and its data are replicated to another Azure region/AZ. Azure also offers database-specific migration services to move database data to Azure or from one region/AZ to another. For on-premises data, Azure offers their **Data Box** service (Data Box, Data Box Disk, Data Box Heavy and Data Box Gateway**)**, which is like the AWS Snow series, except that Data Box Gateway is an on-premises software service used to transfer data.

Challenge: Block storage costs

Customers starting out with 100TBs of data often end up with a PB or more, within years. The value of all that data is also increasing now that AI/ML can scour it to capture customer and operational insights. The main challenges with PBs of data are the cost of provisioning it, storing it, protecting it and, in the case of the cloud, accessing it.

Dell APEX Block Storage for Public Cloud supports **thin provisioning**, which can initially reduce the storage footprint substantially to serve operational needs. Most data sets and volumes start small and grow over time. With **thick provisioning**, customers must provision the full final volume size right from

the start or depending on the application using the EBS or virtual disk volume, move data from one volume to another every time data exceeds volume size.

With thin provisioning on Dell APEX Block Storage for Public Cloud, customers could provision 500TB of data but only need 125TB (@4:1 thin provisioning) or 167TB (@3:1 thin provisioning) of usable capacity. As physical data needs grow over time, more usable capacity can be added to the storage system up to its fully provisioned capacity, with no application disruption or data migration.

Once ordered, new on-premises storage infrastructure can take weeks or more to arrive. Because of this time lag, on-premises organizations often use a lower thin-provisioning ratio of 2:1 or 1.5:1. Cloud customers don't have this problem and can run much closer to the thin-provisioning edge as additional cloud storage capacity can be added to the cluster in real time with a few API calls and proper authorization.

The advantage of thin provisioning is that Dell APEX Block Storage for Public Cloud customers only pay for what's needed for current data capacity. This cost always starts out substantially lower than that of a thick-provisioned storage environment.

Furthermore, as discussed earlier, Dell APEX Block Storage for Public Cloud aggregates cluster capacity, IOPS and bandwidth. Any individual volume can run up to its fully provisioned limit but if another equivalently thin-provisioned volume is running at substantially less than its provisioned capacity, the system retains its thin-provisioning advantage.

Another area of interest is snapshot costs. Storage snapshots are often used to create test/dev environments or copies of data for backups. With Dell APEX Block Storage for Public Cloud, customers can issue up to 126 snapshots of a volume. The cost of snapshots on Dell APEX Block Storage for Public Cloud is $0. However, customers must pay for any additional capacity consumed to store these space-efficient, delta snapshots.

When comparing Dell APEX Block Storage for Public Cloud to cloud-native offerings, Dell's cost savings are substantial:

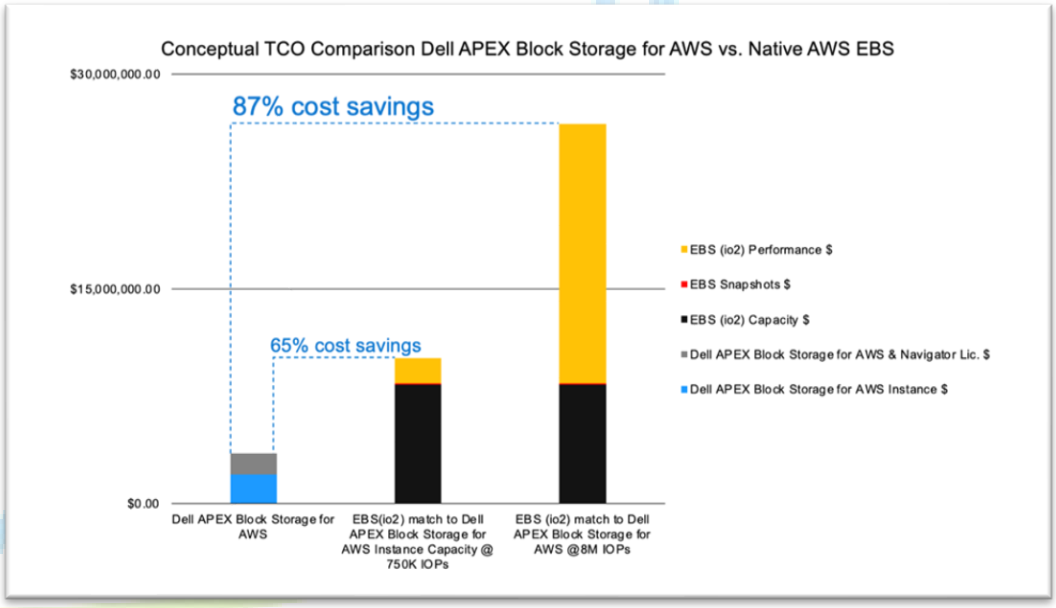
- **For AWS**, EBS storage must include the cost of thick provisioning at a GB per month basis. While storage capacity can quickly be added on demand to EBS volumes, not all applications support volume growth, and some may require data migration or application/configuration changes to support new volume capacity. And as discussed previously, as each EBS volume has its own individual capacity, one volume may run out of storage while the next is almost empty. In this case, an organization will need to add capacity to the out-of-storage EBS volume. As mentioned above IOPS and bandwidth performance come with a minimum level for most storage types, but customers can purchase more where needed. Again, performance on one volume cannot be shared with other volumes. Customers still need to pay for additional performance on a volume-by-volume basis. Further, AWS supports standard snapshot on S3 and snapshot archive storage, and EBS snapshots are charged on a GB per month basis. EBS snapshot archive storage is cheaper, but the first archived snapshot is a full copy of the volume, and customers are charged extra when archive snapshots are restored. EBS standard snapshot storage incurs no additional

cost to restore and consist of only the capacity to store delta or changed data since the prior snapshot but restore times from standard S3 snapshot storage are substantially slower.

- **For Azure**, managed virtual disks are also thick provisioned and are priced separately on a GiB per month basis. Thus, the discussion above regarding thick-provisioned AWS storage applies to Azure as well. For managed virtual disk types that offer provisioned performance, customers pay for every increment of performance above a baseline on a volume-by-volume basis. Azure virtual disk snapshots are charged for on a GiB per month and are delta or change-based snapshots after the first full active copy is taken. In addition, the lack of aggregation of performance and capacity in AWS EBS applies to Azure-managed virtual disks as well.

Conceptual TCO: Dell APEX Block Storage for Public Cloud vs. AWS EBS and Azure Virtual Disk block storage

For AWS, we configured a Dell APEX Block Storage for AWS system using a 4:1 thin-provisioning factor, for instance storage on i3en.12Xlarge instances with Intel® Xeon® Scalable processor CPUs.[4] We compared the cost of that configuration to a performance-and thick provisioned capacity-matched EBS io2 block express configuration[5] and a thick provisioned capacity matched EBS io2 block express configuration only capable of 750K IOPS.[6]



Based on ~8M IOPs, this 87% cost-savings is for a very high-performance configuration that falls outside most workload requirements. However, even at a more realistic 750K IOPs, Dell APEX Block Storage for AWS still

[3]. **Dell APEX Cloud Block Storage instance high performance** = 38 i3en.12xlarge instances, each with 4 x 7500 GB NVMe SSDs per instance and a licensed Dell APEX Block Storage for AWS and Navigator costs for 513.0 TB (1.1 PB raw and @4:1 thin provisioning is 1.9 PB) usable capacity split into 461.7 TB primary and 51.3 TB snapshot with an aggregate performance of 7,740 KIOPS. EC2 instance pricing is reserved instances, 100% upfront for 36 months or 3 years.

[5]. **EBS match for instance capacity and high performance** = 616 EBS io2 block express volumes with 3000 GB each and 12.5 KIOPS/volume for a total of 7,740 KIOPS performance with a primary capacity of 1,846.8 TB and a snapshot capacity of 51.3 TB.

[6] **EBS match for instance capacity** = 231 EBS io2 block express volumes with 8000 GB each and 3249 IOPS/volume for a total of 750 KIOPS with a primary capacity of 1,846.8 TB and a snapshot capacity of 51.3 TB.

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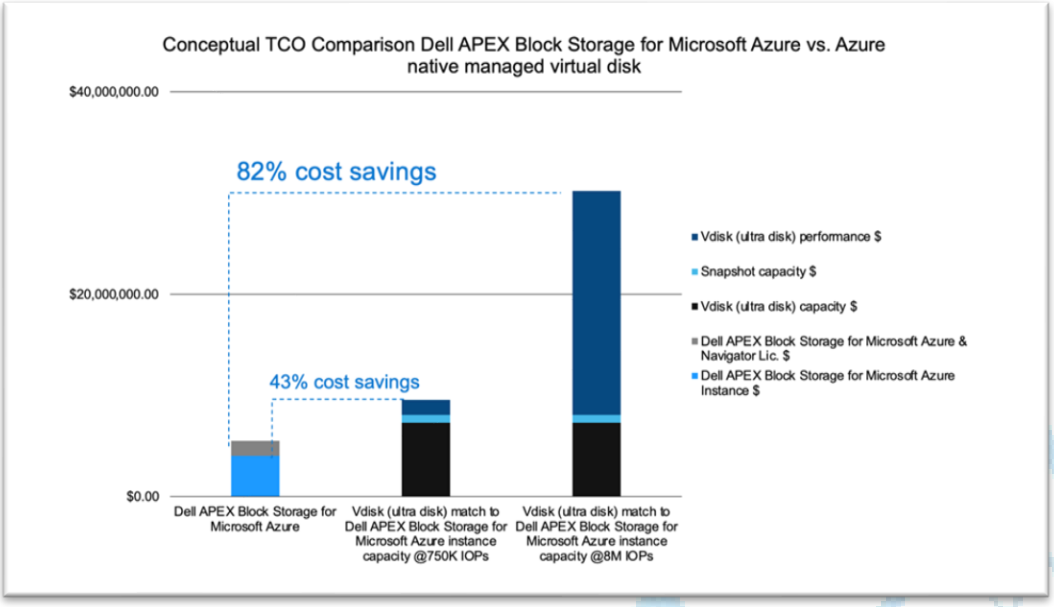
achieves a 65% cost-savings, without any change in the Dell configuration. That is, the Dell APEX Block Storage for AWS supports ~8M IOPS while the comparison EBS configuration only supports 750K IOPS.

For Microsoft Azure, we configured a Dell APEX Block Storage for Microsoft Azure system using 4:1 thin provisioning on instance NVMe storage for high performance,[7] and compared this with a performance- and thick provisioned capacity-matched Azure ultra disk configuration[8] and a thick provisioned capacity-matched Azure ultra disk configuration only capable of 750K IOPS.[9]



As the chart shows, Dell APEX Block Storage for Microsoft Azure offered 82% cost savings compared to the Azure performance- and capacity-matched ultra disk configuration.

This 82% cost savings is based on an ~11M IOPs, very high-performance configuration. But customers can still see up to 43% cost savings at 750K IOPs with Dell APEX Block Storage for Microsoft Azure, again without any change in the Dell high performance configuration.

Note that your cost differences may vary widely depending on the thin-provisioning factor used, the AWS and Azure region, the data change/snapshot rates, throughput requirements, capacity used, the type of storage and instances used, etc. (for the Dell APEX Block Storage for Public Cloud and native cloud alternatives) in the configurations.

Dell APEX Block Storage for Public Cloud Use Cases and Workloads

On-premises customer applications that use PowerFlex storage include just about any data center application that needs block storage. As Dell APEX Block Storage for Public Cloud brings all the best of on-premises PowerFlex to Amazon AWS and Microsoft Azure, similar uses in the cloud are now possible.

[7] **Dell APEX Cloud Block Storage instance high performance** = 73 L64as_v3 instances each with 4 x 1,920 GB NVMe SSDs, supporting an aggregate IOPS performance of 10,700 KIOPS and throughput performance of 239,000 MBPS with a licensed Dell APEX Block Storage for Microsoft Azure and Navigator cost for 504.6 TB usable (1,121 PB raw and @4.1 thin provisioning is 1.8 PB)) split between 454.1 TB primary and 50.5 TB snapshot capacity. Azure instance pricing is reserved instances, savings plan, for 36 months or 3 years.

[8] **Azure match for instance capacity and high performance** = 3,305 ultra disk volumes with 512 GiB each at 3.2 KIOPS/volume and 72 MBPS/volume for a total of 10,700 KIOPS and 239,000 MBPS with 1.7 PiB primary and 423.0 TiB snapshot capacity to match the Dell APEX Block Storage for Azure configuration.

[9] **Azure match for instance capacity** = 414 ultra disk volumes with 4096 GiB each at 1,812 IOPS/volume and 40 MBPS/volume for a total of 750 KIOPS and 16,752 MBPS with 1.7 PiB primary and 423.0 TiB snapshot capacity to match the Dell APEX Block Storage for Azure configuration

For **databases**, consistent high performance, that is, low latency, high IOPS and high throughput as well as high data availability are all important considerations for enterprise business critical applications. Databases are the foundation of most enterprise applications, and Dell APEX Block Storage for Public Cloud offers consistent high IO performance, linear scalability and high data availability when hosting enterprise database data.

Further, developers and testers usually want real-time access to critical enterprise data for their **test/dev** activities. Most enterprises would not allow developing or testing new applications with current data. Snapshots work equally well in the cloud, enabling a new test/dev environment to be stood up in minutes and providing developers and testers with an exact duplicate of the organization's application data.

Any enterprise that processes data in the cloud or a data center will likely need a **DR** solution. PowerFlex SDR makes it easy to set up a DR environment in other clouds, other regions, or other on-premises data centers.

Summary

Dell APEX Block Storage for Public Cloud delivers several functional advantages over AWS EBS- and Microsoft Azure-native volume storage offerings. Benefits include more performance for the money, thin provisioning and aggregated performance and capacity across the cluster.

Dell APEX Block Storage for Public Cloud also offers up to 87% cost savings over equivalent AWS EBS volume storage and up to 82% cost savings over equivalent Microsoft Azure managed virtual disk storage. In addition, this price comparison includes Dell APEX Navigator for Mulitcloud Storage, which provides simplified, consolidated management for the offers in the Dell APEX Storage for Public Cloud Family.

All in all, the extensive functionality advantages plus significant cost advantages of Dell APEX Block Storage for Public Cloud over their native cloud competition serve as substantial justification for choosing Dell APEX storage for any enterprise cloud block storage deployment.

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

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