NAS filers have been in use for the past two and a half decades and have been the gold standard for sharing files, media, and other unstructured data in organizations ranging from small offices to the largest enterprises. However, as the volume of unstructured data has been growing at an unmanageable rate, the limitations of the traditional, on-premise NAS model in terms of economics, scalability, and durability have made it an impractical choice for the modern data center.

Modern data centers are looking to the cloud to offer a solution to these limitations. The cloud can offer levels of durability, availability, and scalability at a cost that no traditional NAS solutions can match. Still, by itself, the cloud cannot offer intelligent data services such as deduplication and compression, non-disruptive application support, or the performance of local NAS.

An intelligent hybrid cloud NAS solution combines all the benefits of the cloud with local caching for performance, as well as advanced data services such as deduplication, compression, and encryption. When combined with a cloud file system, this can offer a far superior solution compared to traditional NAS.

However, many IT organizations have questions around the performance of hybrid cloud NAS. When compared to local NAS, remote cloud based storage can introduce latency that may be outside of the SLAs required for mission critical applications. This paper will discuss the performance advantages of a hybrid cloud NAS solution – one that delivers the SLA and local data center performance of flash for NFS and SMB-based applications with the scale, economics, and durability of the cloud.
A traditional NAS filer can be used in a wide variety of use cases. Over the past two and a half decades filers have been used for home directories across all industries; as part of render farms for media and entertainment; as artifact repositories for continuous integration/continuous deployment (CI/CD); as content repositories for major websites; and as tier one NAS behind mission critical databases in financial institutions. In these varied roles, there have been 70/30 read/write workloads; 50/50 workloads as application workflow sharing points; and low latency 30/70 transactional workloads. As we move toward the cloud as our eventual data resting place, how do these workloads translate to hybrid cloud NAS?
Hybrid Cloud NAS presents itself like any other filer with well known, client facing protocols like NFS and SMB. It has similar filer performance expectations for read and write workloads, with the added ability to scale both performance and capacity on an as needed basis through the addition of storage media. Along with these traditional capabilities, hybrid cloud NAS also moves data to a cloud object store in near real-time in order to provide the immediate data durability of offsite cloud repositories. Once in the cloud object store, hybrid cloud NAS takes advantage of the scale-out object store to replicate the data and make it available at other locations, also in near real-time.

So then, can any workload be moved to a cloud filer? The answer is in the data and the network. The write bandwidth to the object store from hybrid cloud NAS eventually limits the sustained write throughput of the hybrid cloud NAS solution. Likewise, the read bandwidth from the object store eventually limits the data read rate. Hybrid cloud NAS can use local cache to mitigate the impact of reading data from the remote object store, but any client requests for data that miss the cache must go to the object store, thus impacting performance.

As an example of the write limits, if the client workload is writing at 10 Gbps to a hybrid cloud NAS solution which has a 1 Gbps connection to an object store, eventually that 10:1 write ratio is going to fill whatever quantity of write-buffering depth the hybrid cloud NAS solution has available. At that point, the client write rate will be limited to the object store connection rate.
With a Panzura Freedom hybrid cloud NAS solution, a typical, but data dependent 2:1 compression and global deduplication ratio, would also double the effective write bandwidth to the cloud object store. It is critical to make sure that your sustained write load roughly aligns with your cloud object store bandwidth. Every cloud filer should be able to take high 10+ Gbps burst write loads and smooth them out to a sustained multi-gigabit cloud object store write rate. This is critical for making the hybrid cloud NAS solution feel and act like a traditional NAS filer to the connected clients.

At Panzura, we find that the best workloads are those where the client behavior, read cache miss rate, and write rate are all matched to the object store network rates.

**Filer Workloads**

A typical 70/30 workload for home and project directories centered around user activity has the 30% write rate matched to the client write rate and the 70% read rate matched to the client read cache hit rate and working set. Panzura offers 10 Gbps and 20 Gbps (with a high performance NVMe SLOG) NFS solutions that match this 70/30 ratio after sizing the cache to the specific workload and dataset (typically 10% of the dataset size) in order to maintain this performance level.

A typical 50/50 workload where applications are using hybrid cloud NAS as a point of sharing and transport of the data, would be sized to hold the working set of the data and have the write rate dictate the entire system throughput. This sustained write rate should roughly align with the cloud object store connection write rate while taking bursts from the application(s) at the highest rate available. Like the previous deployment model, Panzura has NFS solutions in the 55xx and 57xx series that handle 10 and 20 Gbps bursting and match that to your object store connectivity rate, which typically limits the overall solution. In addition, the 57xx series contains an NVMe SLOG device to significantly increase performance of NFS synchronous write operations critical to many data intensive applications. For these solutions, Panzura also has VM deployments that can match their hardware equivalents while allowing more flexible deployment options.

Next we have workloads with high write rates. With limited reads, most of the resources are focused on compressing and deduplicating the data while moving it to the object store. These deployments will be limited by the remote network connection with the 55xx series targeting the 2-5 Gbps write rate and the 57xx targeting the 5-10 Gbps write workloads.

Lastly, random read/write workloads which need low latency require large local caches that can represent the entire dataset. Since hybrid cloud NAS needs additional IOPs and bandwidth for moving the data to the object store, typically about 2x, doubling the IOP requirement from a traditional NAS deployment is typical.
Conclusion

Hybrid cloud NAS solutions are supplanting traditional filer workloads due to their ability to enable organizations to gain the economics, scalability, and durability of the cloud without sacrificing data center performance, and they will continue to add their value to the storage stack on more workloads over time. Performance in a variety of deployments is expected to be on par or better than traditional NAS while extending capabilities into the cloud. Today Panzura supplies intelligent hybrid cloud NAS solutions that deliver 10 and 20 Gbps NFS performance with low latency matching traditional NAS, while adding the near real-time off-site repository durability and scalable remote site replication.