NETAPP FLASH SOLUTIONS
YOUR DATA DEMANDS MORE

NetApp Spotlight on Technologies

Increasing Enterprise Application Performance with Flash Storage

Enterprise applications are the lifeblood of IT. We rely on them for everything from optimizing manufacturing to tracking customer satisfaction. NetApp helps align enterprise application performance, management, and growth with business priorities through the use of its flash storage systems. This paper examines the criteria for selecting flash storage in support of enterprise applications and makes recommendations based on the strengths of each flash system.

Overview

Imagine a day in the life of a storage architect. Data capacities have climbed to record levels. Meanwhile, application users are demanding higher data throughput and lower latencies. Easy, right? Well, yes, in some respects. Faster CPUs blaze through I/O instructions more quickly than ever. Multicore CPUs permit simultaneous I/O instructions to be processed. Solid-state storage devices can literally move data at lightning speed. So, yes, the storage architect has many tools readily available, but it's still up to the architect to make the right choices, put everything together, and make it work flawlessly.

In this paper, we examine three common considerations in the design of storage architectures suitable for enterprise applications: performance, management, and Scale-out capability. Although a single storage system could address all three areas, it is often the case that one storage system outshines the others in one aspect of enterprise application support, while another storage system shines in another area.

Enterprise Application Performance

When the utmost in application data performance is desired, architects often look at industry performance benchmarks to help determine which storage system to use. The Storage Performance Council's[1] SPC-1 benchmark simulates workloads from high-speed data applications such as OLTP and mission-critical database operations.

SPC-1 is often the first place looked to when determining one vendor's performance against others. As demonstrated in SPC-1, the NetApp® EF560[2] all-flash array was a top performer, processing 319,980 I/O operations per second (IOPS) under maximum load. In other words, the EF560 processed 1.15 billion operations per hour. Although the I/O processing specs are impressive, perhaps more impressive is the consistency with which the EF560 delivered this performance. A key measurement for high-performance storage arrays is response time, or the average time it takes to process an I/O request, measured from start time to completion time.

Typically, as a storage array begins to process more instructions, the response time increases, sometimes dramatically, because the array struggles to keep pace with the increased workload. This can result in an undesirable latency spike as the array approaches full utilization. However, by applying operating system code optimization with flash SSDs, NetApp's storage designers were able to reduce latencies across the entire spectrum of workloads.

For the EF560, this means that response times were consistently measured at less than 1ms regardless of load. In fact, the best latency time recorded by the EF560 during SPC-1 benchmark was a noteworthy 170 microseconds, one of the lowest latencies in SPC history.

With enterprise storage arrays processing billions of I/O instructions per day, every microsecond counts. The EF560 represents NetApp's latest generation of all-flash high-performance storage arrays, with sustained and consistent performance. If your enterprise application demands the highest possible performance, the NetApp EF560 is the clear choice.

NetApp®

[1] http://www.storageperformance.org/home/

[2] http://www.netapp.com/us/media/ds-3648.pdf

Enterprise Application Management

Experienced storage architects know that the underlying storage, powering their applications, can also help fix broken applications and make them run right when everything around them seems to go wrong. Specific to enterprise databases, three primary data storage problems can cause things to go wrong:

- Inconsistent database I/O performance
- Lack of database availability
- Database table corruption

If enterprise application uptime and fault recovery are primary concerns, the NetApp All Flash FAS[3] (AFF) system is rich in management features that address these issues and help make sure of continuous operation.

Inconsistent Database I/O Performance

Most enterprise applications, particularly those utilizing databases, experience periods of performance spikes. Spikes can dramatically slow down application response times and usually occur during predictable events: a special promotion, a seasonal pattern, end-of-month and end-of quarter reporting periods, and so on. Although these periods are predictable, they are not necessarily planned for. To prevent performance spikes from affecting operations, NetApp's AFF offers two solutions

- NetApp Virtual Storage Tiering is an automated method for moving hot data to a flash tier. As data is accessed, it is automatically promoted to flash. Hot data remains in flash, while cold data is evicted. In this way, the effect of performance spikes can automatically be minimized.

- NetApp SnapMirror® is another method of accommodating seasonal spikes by seamlessly moving entire applications between storage tiers. For instance, a retail company might require accelerated point-of-sale application performance during peak buying periods. To accomplish this, the entire application could be transparently migrated to a higher performance storage system in anticipation of high-load periods.

Lack of Application Availability

Scheduled downtime for system maintenance is often disruptive to application users. NetApp eliminates planned downtime through a well-thought-out approach to nondisruptive operations (NDO). NetApp NDO enables upgrading and maintaining any aspect of the AFF storage system by making sure that maintenance-related I/O interruptions are brief enough so that applications continue to operate without needing downtime, maintenance, or user notification. The end result is 24/7/365 continuous availability of critical enterprise applications.

Application Data Corruption

When database corruption occurs, rather than being catastrophic, it is more likely to be a problem that prevents access to a certain table within the database. With NetApp, DBAs can quickly pinpoint the problem by rolling back to earlier NetApp Snapshot® copies until they find a clean (uncorrupted) database copy. After the clean copy is identified, a virtual clone is created using NetApp FlexClone®, where redo logs are applied to quickly bring the recovered DB up to date. This process can shave hours or even days from the typical time to recover from database application corruption.

Enterprise Application Scale-out

Many enterprise applications do not require blazing speed or tight application management, but have unpredictable growth, making it difficult for storage architects to accurately size them. An example of this type of application includes big data analytics warehouses. For enterprise applications with erratic growth, the NetApp SolidFire[4] all-flash storage system provides a convenient solution. A number of features differentiate SolidFire from EF560 and AFF flash-based systems for this environment:

- Storage nodes are based on inexpensive commodity hardware.
- Scale-out, shared-nothing architecture supports up to 100 nodes.
- Automatic data rebalancing occurs within minutes after nodes are added or removed.

After a SolidFire all-flash storage system is initially configured, its node-based cluster can be grown in a very granular fashion, adding server nodes with varying profiles of performance and capacity to keep incremental costs small and predictable. SolidFire was designed with next-generation applications in mind. Management overhead is minimal, and everything can be automated using well-documented APIs.

SolidFire resource pooling provides nondisruptive expansion across data center layers. Adding another server node to the pool effectively expands CPU and memory along with storage capacity, and these resources can be scaled in or out to meet changing business demands.

Projecting business needs two years, three years, or five years out becomes a nonissue, because your infrastructure can scale incrementally as your requirements change. Linear, predictable growth of capacity and performance with guaranteed quality of service (QOS) is an essential operative in the next-generation data center, which makes a scale-out design such as that of SolidFire critical to success.

[3] http://www.netapp.com/us/products/storage-systems/all-flash-fas/

[4] http://www.netapp.com/us/products/storage-systems/solidfire/index.aspx

Flash and Enterprise Applications Within a Unified Data Fabric

The Data Fabric is NetApp's vision for the future of data mobility. A Data Fabric seamlessly connects different data environments across a fabric into a cohesive, integrated whole. Although the Data Fabric is constantly evolving, organizations can start taking advantage of it today using NetApp technologies that enable data management and seamless data movement across the hybrid cloud. (See Figure 1.)

The Data Fabric combines integrated data movement of flash-based systems and the management and automation capabilities of a uniform management portfolio. With the Data Fabric, customers have a common set of enterprise data services throughout the Data Fabric and mobility that places enterprise application data where it's needed, when it's needed.

Summary

Enterprise applications are the lifeblood of IT. NetApp helps align enterprise-wide application performance with business priorities and growth through the use of multiple flash storage architectures and a Data Fabric. NetApp's multiple flash storage solutions address the priorities a storage architect would commonly encounter while constructing enterprise storage architectures. A Data Fabric seamlessly connects diverse application environments across disparate endpoints into a cohesive, integrated whole. As illustrated by the examples in this document, NetApp technologies allow businesses to satisfy diverse enterprise application requirements.

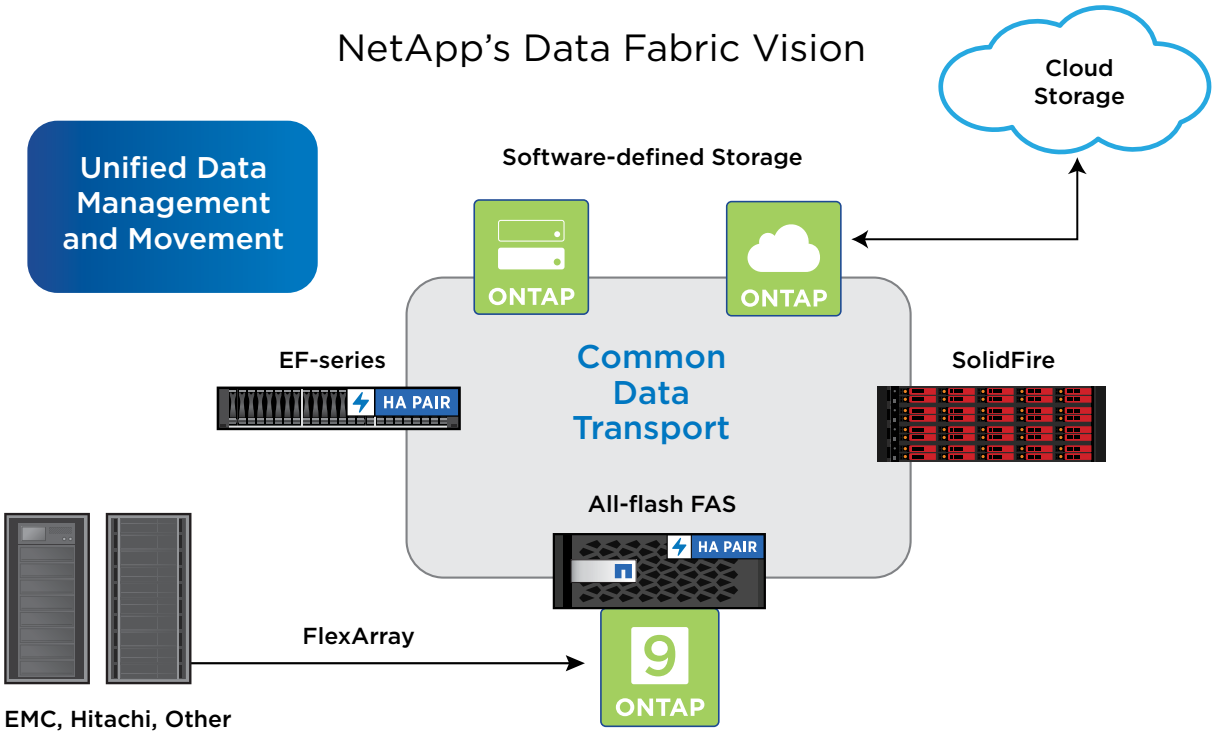

Figure 1) Data Fabric enabled by NetApp.

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