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IS YOUR SAN ARCHITECTURE READY FOR FLASH?

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Flash based storage, whether it is added to an existing hard drive system or a dedicated flash array, can enable data centers to attain a greater return on investment (ROI) on virtualization (desktop and server) and database application infrastructure. The responsiveness of flash provides higher levels of density, more virtual machines per host and more users per database instance. The challenge is that these highly parallelized environments combined with the near zero latent architecture of flash based storage, expose weaknesses in legacy IP and Fibre Channel storage architectures. Simply put, 1GbE and 4Gb FC are not capable of allowing flash storage to reach its full potential.

The Performance Gap

For the last decade, the performance of compute resources has outpaced the capabilities of the surrounding infrastructure. But this available compute power went largely untapped in the single application, single server architecture. In addition, the storage media's performance had been stuck at 15k RPM hard disk speeds for over a decade. As a result, the latency of this rotational media was the biggest bottleneck to performance. Due to this bottleneck, there was limited motivation to upgrade the storage network or to make any dramatic shifts in architecture design.

In the modern data center, desktop and server virtualization, as well as more scalable database technology, can take full advantage of the available compute processing power. At the same time, flash based storage systems now eliminate the bottleneck caused by legacy hard disk based storage media. As a result, at the server end of the infrastructure there is a demand for performance and at the storage end there is the ability to deliver that performance.

The challenge now, however, is the infrastructure in the middle; the storage network. As the shift is made to high density compute and near zero latent storage, the storage network infrastructure also needs to change. If not, a performance gap exists which makes flash storage investments less appealing since they are not capable of delivering the return on investment that is expected.

The Server Side Band-Aid

Since the performance gap caused by aging storage architectures was hurting the effectiveness of flash storage, some flash vendors made an attempt to circumvent the storage network altogether and create server side solutions. These server-side solutions are typically either solid state disk drives (SSD) or PCIe based flash storage.

Initially they were used to store temporal server data like read caches, virtual memory pools or temporary files, like redo logs. Those use cases are an ideal and appropriate use of the technology. But storage vendors added the capability for these server-side flash solutions to function as their own islands of discrete storage.

The problem is that most environments today are clustered. Clustering allows the advances in compute to be correctly leveraged but clustered servers depend on shared storage in order to operate. Creating silos of direct-attached fast storage won't work in these environments. This led server side flash vendors and caching software developers to advance their technologies to support clustered infrastructure. Server-side flash vendors have added the ability to aggregate flash storage inside these servers and create a shared flash pool, more appropriate for clustered environments.

The bottom line is that these aggregated server side flash solutions add complexity to the way data is stored. They also create another storage network, one that needs to be managed separately and may not have any tools developed to help the IT Professional do so. It begs the question, instead of installing a new and unproven network, why not just improve the storage network that is already in place?

The ROI of High Performance Storage Architectures

Before examining the challenges with legacy storage, it is important to understand the value of a next generation, high speed storage architecture. A more capable storage infrastructure enables the creation of a denser compute tier. It also enables a higher performing flash storage tier. This leads to a significant improvement in ROI, thanks to the fact that virtual machine density can be greatly increased in virtualized infrastructures. It can also lead to an increase in the number of users supported per database server, be it virtual or dedicated server.

Increased server density enables organizations to purchase fewer servers or hosts for the environment. Since the modern host is more powerful from a compute standpoint, more "rich" from a capabilities standpoint, and more expensive from a budget standpoint, the ability to leverage each host to its fullest extent is critical. The reduction in server purchases not only leads to an upfront cost savings, it also leads to a long-term reduction in power and cooling costs as well as data center floor space consumption.

There is also an ROI associated with management simplicity. Clustered environments expect to be on a shared storage system, not shared across a series of loosely coupled direct-attached storage devices. While these environments can be made to work, they are not the norm. Furthermore, they are not well tested in terms of production installations, nor do they have the rich tool sets available to support monitoring, troubleshooting and fine tuning.

The Challenges With Legacy Architectures

Any storage architecture consists of three components: the actual storage arrays, the HBA that goes in the server/host and the switch that connects them together. There tends to be two types of infrastructures available, one that is Fibre Channel based and one that is based on Ethernet or IP (using either iSCSI or NFS). It is important to note that despite the hype, the overwhelming majority of virtualized or database environments run on a Fibre Channel architecture.

Legacy architectures are simply too slow for the modern data center. Typically they are either 1GbE IP or 4Gb FC protocols. There is too much compute storage I/O demand and the flash media is ready to respond much faster than the legacy storage network can transmit.

To achieve maximum ROI, upgrading the storage network should be considered a top priority. In the past, most storage network upgrades happened partly as a result of obsolescence. In other words, it became cheaper to buy a 4Gb FC HBA than it was to buy a 2Gb FC HBA. Now, thanks to dense compute and responsive flash storage, there is value with investing in a new storage network. In terms of ROI, a storage network upgrade can nearly pay for itself due to its ability to help enable denser computing and utilize the full performance of flash.

With the need to upgrade the storage network becoming more obvious, the choice of which protocol to use becomes a key issue. There are several upgrade options; Ethernet based protocols can now deliver 10Gb of bandwidth and Fibre Channel, thanks to Gen 5, can deliver 16Gb of bandwidth. When it comes to maximizing compute density and realizing full flash performance, Gen 5 should be strongly considered by IT Planners.

Why Gen 5 As The Modern Architecture

Gen 5 has several advantages over the other storage networking architectures that make it ideal for deploying in dense compute, flash storage environments, including:

- **Raw bandwidth.** Not only is 16Gb bandwidth greater than that of 10Gb Ethernet, but it is more "pure" in that there is almost no overhead to the Fibre Channel protocol. On the other hand, IP in almost every case has to do some sort of protocol conversion. In addition, it has to manage IP packets that were designed for small message transfer; not large block storage traffic.

  While some of this overhead can be off-set by leveraging network interface cards that can off-load the IP processing, these cards drive up the cost of the IP network and creates complexity as a mixture of enhanced and standard cards will have to be configured. By comparison, it is not uncommon for an entire storage infrastructure to standardize on one network interface card and one storage switch.

- **Flatter.** Gen 5 does not have multiple layers of an IP network nor does it have to contend with spanning tree protocol (STP) issues; common in almost all IP architectures with the exception of FCoE. With STP, all redundant paths are blocked. While blocking an inexpensive and inefficient 1GbE network connection is not a major concern, blocking a high speed connection is. Having a 10GbE IP connection effectively sitting idle is a significant waste of bandwidth and switch ports. With all generations of FC, all paths or network connections are active, a critical factor when a high performance storage network is implemented.

- **More controllable.** While 16Gb of bandwidth is a significant step forward, IT Planners should demand control over which hosts or virtual servers get priority access to that bandwidth. In a virtual environment, this requires VM level visibility and control. NPIV, also known as N_Port ID Virtualization, is a capability that is unique to Fibre Channel. It allows for specific virtual machines to be "tagged" as a high, medium, or low storage I/O resource consumer. This capability allows for quality of service (QoS) that is required to virtualize mission critical workloads.

Conclusion

Flash storage may be the straw that breaks your storage network's back. When combined with high density compute, it can expose a serious performance gap that limits the ability to scale the data center for maximum return on investment. Unlike the past where storage network upgrades could be a "slow-roll" by replacing obsolete parts, now complete storage network upgrades need to be seriously considered. Thanks to its raw performance bandwidth advantage, its efficiency in utilizing that bandwidth and its fine grained control over how that bandwidth is allocated, Gen 5 Fibre Channel deserves top consideration as the network of choice.