The Trusted Foundation for Storage

EDISON
www.theedison.com

FCIA
FIBRE CHANNEL INDUSTRY ASSOCIATION

Executive Summary

Virtualization can dynamically scale compute resources and accelerate server and application deployment. In the process, virtualization also increases overall density of data centers and as a results can place critical strain on storage resources. Implementing the right network architecture prevents consolidated IO from driving bottlenecks within the storage network. Fibre Channel helps to alleviate IO discrepancies and extends the overall benefits of virtualization.

Why Fibre Channel for Virtualization?

- Highest bandwidth to support increasing VM densities
- Maximum IO performance to alleviate IO discrepancies
- Deterministic connectivity for superior reliability and data integrity
- Isolate data and restrict access for increased security
- Reduce administrative time and costs through simplified management

The Role of Fibre Channel in Server Virtualization

Fibre Channel Innovation for Server Virtualization

Enterprises deploy server virtualization to improve utilization, consolidate server infrastructure, improve business agility and enhance disaster recovery capabilities, in the process reducing total cost. Fibre Channel is the primary choice for storage connectivity in these environments because it delivers high performance, reliability, security and manageability needed to support high density virtual machines (VMs) running business critical applications.

Advancements of server processing and compute power, paired with the the latest virtualization software, creates a new game-changing compute platform. Current versions of VMware's vSphere support more than 60 vCPUs per physical server, while Microsoft Windows 2012 environments support up to 255 virtual functions per host. Networks supporting virtualized applications with hundreds or even thousands of VMs require access by users demanding guaranteed communication to their applications data. Fibre Channel provides this extremely reliable, lossless, and congestion free environment with low latency to provide the constant-on capabilities and predictable application performance that users demand. Without this, costs can be high, applications can lose connectivity, which can result in dissatisfied customers and lost revenue.

Alleviate IO Discrepancies

For customers with large numbers of high input/output (IO) and tier-1 applications running on VM hosts, Fibre Channel provides the necessary high performance connectivity to satisfy the IO requirements of their most demanding applications. These high performance virtual server platforms support not only new levels of VM density, but also tier-1 applications that previously required dedicated server hardware. Highly virtualized environments generate a tremendous amount of IO traffic, and as the number of VMs per server increase, so does the volume and complexity of IO traffic, magnifying the IO performance bottleneck issue already present in most enterprises. Increased bandwidth is needed to aggregate IO from multiple VMs from a single host's data path. As densities increase and companies move mission critical server and database applications onto virtualized servers, the robust nature of Fibre Channel becomes a requirement to satisfy data integrity and new high bandwidth, low latency IO requirements. The results drive down operational costs and enable enterprise data centers to unleash the full potential of high density server virtualization deployments. Fibre Channel is helping to create and extend the overall benefits of virtualization by enabling higher consolidation ratios and increasing application performance. The advantages of Fibre Channel don't stop at high performance however; they extend beyond, delivering many important capabilities that take SAN reliability, availability, and management simplicity to the next level.

Reducing Complexities and Simplifying Management

Fibre Channel enables higher densities and facilities flatter fabrics that reduce network management and cabling complexities, helping to cut costs and simplify fabrics and consolidation. Fibre Channel provides superior architectural design flexibility for deploying a variety of different topologies to dramatically reduce the number of ISL cables required, further reducing network complexity and costs.

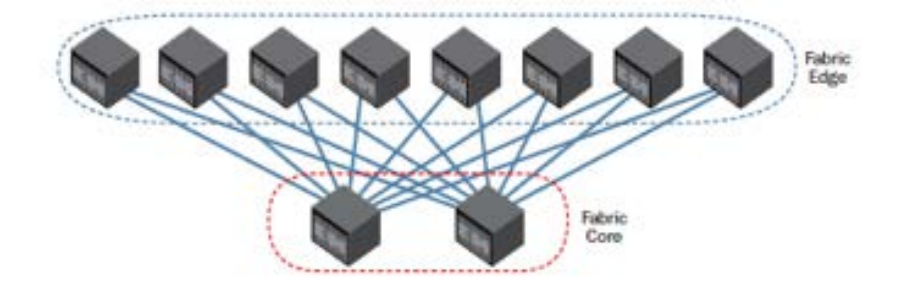

Figure 1: Fibre Channel Allows for Flatter, Simpler Fabrics helping to Reduce Cost and Complexity

The Trusted Foundation for Storage

While there are many benefits to virtualization, it can also add a layer of management complexity by abstracting visibility of the application from the network. Without virtualization-aware manageability, the value of virtualization is severely diminished. By leveraging built-in features within the protocol, Fibre Channel offers a simple and easy-to-use functionality to configure, monitor, and maintain storage connectivity. Add vendor developed APIs and third-party policy-based management, and orchestration functionality can be enabled. With this, storage administrators do not have to give up their favorite management tools when they move to high-performance, virtualized environments. Fibre Channel enables simplistic management and gives them visibility to differentiate their solutions, while preserving investment in many of preferred management tools.

Greater Throughput and IOPS Equals Higher Consolidation

Each generation of Fibre Channel has doubled in bandwidth, with the latest generation supporting 16Gbps. Throughput improvements can be seen through greater IOPS and also increases in CPU efficiency per IO, enabling hypervisors to support enterprise applications, more storage devices and meet bandwidth requirements through fewer Fibre Channel links. Fibre Channel's high bandwidth for large block transfers can benefit from advanced features within hypervisors like VMware's vSphere® Storage vMotion®, ensuring successful migrations of mission critical stored data. Another example is the improvement in random read IOPs at smaller 4KB block size, this benefits VM components like VMware® View™ enabling delivery of virtualized desktops, applications and all while providing a better end-user experience. The high bandwidth, IO performance and low-latency execution of Fibre Channel allows enterprises to proceed with confidence when increasing server virtualization ratios and VM densities. The charts below introduce the scaling advantages 16Gb Fibre Channel has over 8GFC in a virtualized environment.

A key innovation that fully complements server virtualization deployments and makes them scalable is the development of N_Port ID Virtualization (NPIV). Fibre Channel provides a secure environment for virtualization by isolating and protecting storage devices through the use of zoning and U masking techniques. A physical device port can register within the fabric using several worldwide port names PIVs). NPIV enables a single Fibre Channel port to use multiple addresses (also referred to as multiple virtual ports)when registering with the SAN fabric. This allows a fabric-attached Port to claim multiple fabric addresses. Each address appears as a unique entity to the hypervisor and to each guest OS. This capability provides virtual machines with their own dedicated virtual ports and thus limits storage access to only the assigned resources. Further, the ability to "move" a virtual port and reinitiate it on a different server greatly enhances virtual machine portability for load balancing and disaster recovery. Using NPIV to optimize server virtualization's storage provides an admin with yet another layer of management control. This allows the system administrators to more completely understand what they are delivering to their customers from a virtualization perspective, and provides the much needed layers of metrics.

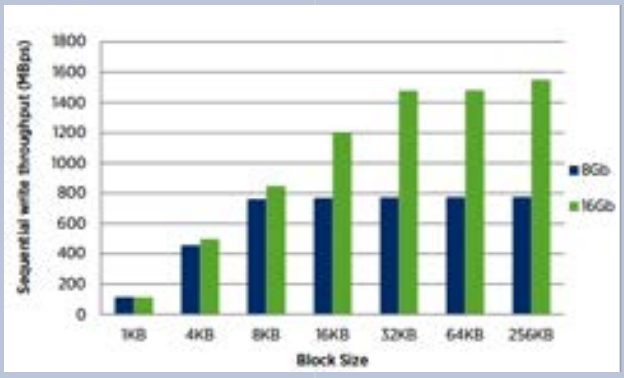

Figure 2: Sequential write throughput in megabytes per second

Shows that larger block sizes (32KB and greater) come close to fully utilizing the 16 Gb FC HBA. Particularly impressive is that with large block sizes (16KB block size and above), the throughput for the 16Gb FC HBA approaches full wire speed and is 90% to 100% faster than that of the 8Gb FC HBA(at 32KB and above).

Source: VMware: Storage I/O Performance on vSphere 5.1 over 16 Gigabit Fibre Channel

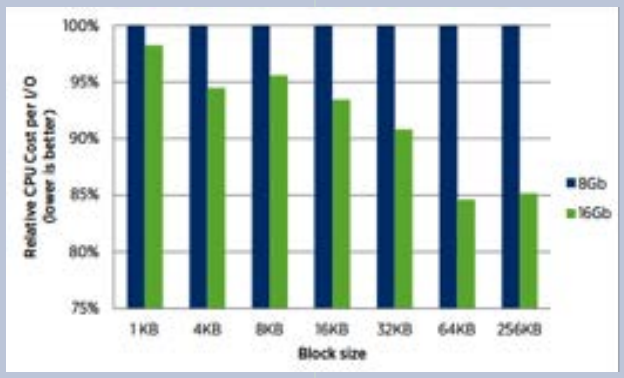

Figure 3: Sequential writes relative CPU cost per I/O (lower is bett erand means a higher CPU efficiency)

Shows CPU efficiency (also known as CPU cost), which is the measure of the amount of CPU resources used by ESXi to perform a given amount of I/O. The CPU efficiency for 16Gb FC is better than 8Gb FC by 10% to 15%, freeing up much need CPU resources for application processing.

The 16Gb FC HBA has better write throughput in smaller block sizes as well. It has better throughput by 56% for a 16KB block size, and better throughput by 10% for the 4KB and 8KB block sizes, all with approximately 5% better CPU efficiency.

Source: VMware: Storage I/O Performance on vSphere 5.1 over 16 Gigabit Fibre Channel

Summary

In a computing era defined by high-density virtualization, advancements in storage networks are called upon to respond to the strains of increased complexity. By choosing Fibre Channel for server virtualization, data centers are assured low latency, uncompromised IO performance and industry leading bandwidth to support tier-1 applications and the highest server consolidation ratios. Fibre Channel also provides flexible architectural design for deploying a variety of different topologies to dramatically reduce cabling and infrastructure, while NPIV provides storage administrators with VM level IO visibility and isolation to assure application level IO performance and security. Rich yet simple management techniques aid in implementing, tuning, and troubleshooting. For these reason, Fibre Channel is the most widely deployed solution for connecting highly virtualized servers to storage.