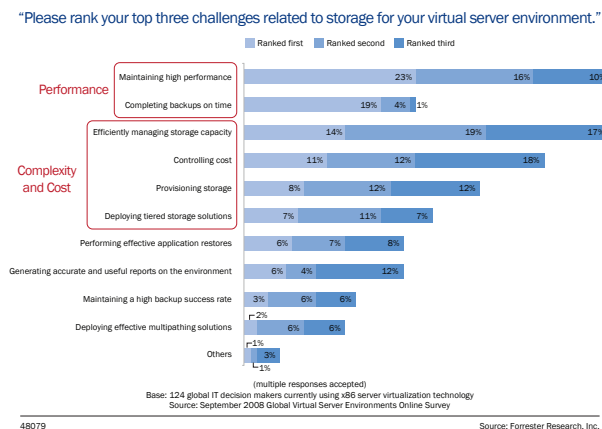




## Broadening VMware Deployment with the Fastest NFS Storage

Organizations face tremendous pressure to deploy, maintain and scale data center resources to meet the dynamic demands of business today. Faced with requirements from a wide variety of users, their applications, and the desire to reduce operational costs, IT managers are drawn irresistibly to virtualization technology and its promise to increase datacenter responsiveness, efficiency and utilization. With VMware® virtualization technology yielding a reduction in hardware and operating costs of up to 50%, many data centers managers have dipped their feet into the virtualization pool. Despite this high interest, the adoption of virtualization technology has stalled in the face of infrastructure challenges leading to low penetration. Studies show that even organizations that have already adopted virtualization, have less than a third of their server infrastructure virtualized. The majority of these virtualized servers run non-mission-critical “Tier 2” production applications such as Web servers, off-the-shelf commercial applications, file/print servers, in-house developed custom applications, as well as Test and Dev applications. “Tier 1” applications such as Corporate Email, ERP, Payroll, Database, Data Warehousing, and Oracle applications are slow to be virtualized. Some industry insiders have coined the term “VM Stall” to describe this phenomenon.

Of all the infrastructure problems data center managers face, the performance, complexity, and cost of storage have been among the most challenging. These have hampered the ability of enterprises to achieve broader, deeper virtualization.



### Virtual Servers Place Real Demands on Storage

Changes on the server front, brought on by virtualization place special demands on storage. Virtualized environments benefit from storage that is simple to deploy, provision and manage. However, this simplicity cannot come at the cost of performance. As the number of virtual machines continues to grow, the need for higher performance cannot be ignored. But virtualization has changed the character of storage traffic, and performance requirements have changed with it.

Traditionally, both sequential throughput (megabytes/sec) and random I/O (IOPS) have been reasonable indicators of performance. In the virtualized data center, the ability of storage to support large amounts of random I/O is more critical. As VM density increases, hundreds or thousands of VM images will coexist on a single shared volume, and each VM will generate storage I/O equivalent to a physical host. Storage must support hundreds of VMs making unilateral demands for data, simultaneously. That means finding information in a virtual disk –

**“In 2010 and 2011 a key initiative in virtual environments is to drive up VM density per host, something that’s difficult without enough IOPS on the storage platform.**

**Assuming a medium sized virtual infrastructure of 50 physical hosts, the total IOPS for the virtual environment alone can reach 187,000.”**

George Crum,  
Storage Switzerland

on a physical disk. It’s not pretty. Virtualization will be aggregating all the storage traffic of all the VMs on these larger and larger volumes, typically into the range of several hundreds of thousands of IOPS. That kind of traffic is amazingly challenging for storage to handle.

The large resource pools of servers and storage infrastructure that are core elements of enterprise virtualization drive massive volumes of I/O. The volumes that host the images of all these pooled VMs experience storage traffic that exhibits extreme randomness, and at an unpredictable volume, as traffic intensity varies with VM workload activity. As a result, the ability of storage to support random I/O at scale can make the difference between success and failure of the virtualization project

To meet their storage requirements, IT managers turn to one of two choices for network storage solutions for the virtualized data center – SAN and/or NAS. Both choices have had their tradeoffs.

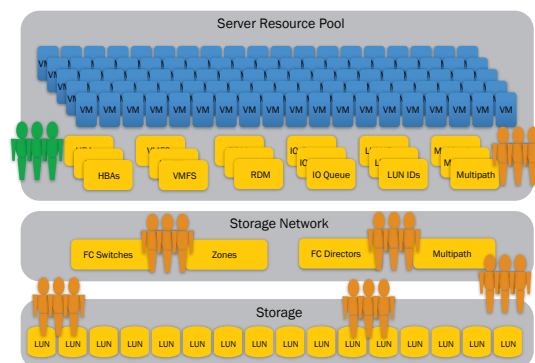
**Using SAN for Performance? Complexity is Included.**

In the quest for high-performance network storage, conventional wisdom has driven storage decision makers towards Fibre Chanel SAN as the choice for virtualized environments. As SAN was an acceptable, if not suitable, storage solution, VMware didn’t feel compelled to fully support NFS storage until 2006. This legacy of delayed support for NFS has caused enterprises to continue to show caution in adopting NAS storage with VMware; despite the obvious cost and manageability benefits.

Unfortunately, SAN was designed for a static server infrastructure. While it might have been the expedient choice at the genesis of data center virtualization, the application of SAN technology in a virtual data center has brought some of its shortcomings into stark relief:

- **Complex Provisioning:** Configuring and provisioning a SAN infrastructure for VMware was, and remains, a non-trivial task involving several manually intensive steps – a challenge due to the dynamic nature of the virtual environment. Most VMware administrators are not comfortable to take all these steps to enable storage for use with virtualization:
  - Setting up LUNs
  - Setting up Raidset for the LUN
  - Assigning LUNs to VMFS datastore
  - Virtualizing the LUN
  - Assigning the virtual LUN to each VM
  - Set up FC multipathing, zoning and masking.
- **Special Equipment, Special Skills:** The SAN infrastructure has its own dedicated infrastructure including HBAs, FC switches, Directors, and specialized management tools. These technologies require a different set of skills and expertise from that used in IP and Ethernet networking. The need for these special skills creates a more “siloeed” data center, increasing complexity and inefficiency, as VMware administrators are dependent on their storage counterparts to provision storage volumes for virtual machines.

Complexity in the SAN Environment





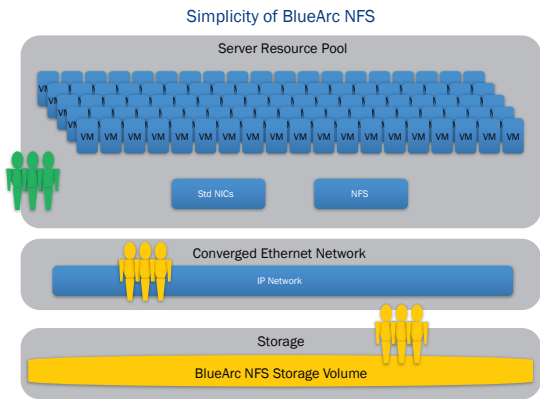
- **Complex Management to provide QOS:** VMware administrators must rely on storage managers to assign LUNs which can be sliced and allocated as needed across multiple VMs. Since the LUN has no awareness of the VMs it contains, the LUN can experience I/O prioritization and contention issues, resulting in storage timeouts. Manually intensive planning and intervention can be brought to bear to mitigate this problem. For example, a Tier-1 mission-critical application can be given an entire, dedicated LUN to ensure a higher application performance. However, all this “tuning” increases complexity.
- **Scaling Leads to Fragmentation and Managerial Complexity.** As hundreds or thousands of VMs are consolidated on resource pools of powerful servers, the scale of shared VM storage needs to align with the total volume of aggregated server resources. LUN size, currently limited to 2TB, has dictated the number and size of the VMs that can be supported. If VMs are too large or numerous, storage administrators must provision a large number of such LUNs. Unfortunately, the provisioning of numerous, small storage volumes creates much greater managerial complexity.
- **Not designed for Random I/O performance:** SAN storage performs best when providing high throughput of sequential disk I/O. This behavior is certainly useful in VM environment. However, SAN demonstrates a reduced ability to support the random I/O commonly seen in VMware environments. Said another way, when megabytes/sec are important, SAN performs admirably; but when random I/OPs are important, SAN comes up short.

**33% of Enterprise customers surveyed were considering replacing Fibre Channel as their network storage protocol for virtual servers.**

- Forrester Research 2009

**NAS to the rescue? But beware of sprawl.**

Traditional NAS has a reputation for simplicity and solves many of the problems introduced by SAN. Based on familiar IP and Ethernet technology, NAS is far easier to provision than SAN. VMware administrators do not need to deal with specialized equipment, management and operations of the parallel FC infrastructure or burden their colleagues on the storage side. Because VMware fully supports it, NFS storage seems like a perfect solution.



**Unfortunately there is a major drawback – limited performance, and the risk of NAS Sprawl.** Traditional NAS systems, work well until the intensity of I/O reaches levels typically seen in medium or large VMware deployments. When performance needs are highest, traditional software-based NAS systems cannot keep up. This is because traditional software-based NAS processors must manage I/O activity, as well as supporting other storage functions, such as snapshots. One approach to managing this limitation is to deploy additional NAS heads, relying on raw computational power to meet the performance needs. Unfortunately this approach leads to the proliferation of hardware, or NAS sprawl, challenging the very notion of NAS simplicity.

**SAN or Traditional NAS: Compromises Required**

IT managers in charge of VMware deployments have had to choose between SAN’s high performance with complexity, or traditional NAS, with much greater simplicity, but lower performance and the potential for NAS sprawl. Today, IT managers no longer have to compromise; BlueArc’ NFS storage provides very high performance levels, including industry-leading random I/O performance at scale, and delivers this performance with the simplicity of an NFS-based solution.

**“BlueArc’s performance over NFS is just fantastic no matter the size of the virtual server or the number of virtual servers. We managed to cut build delivery times by up to 67%.”**

Jon Johansson,  
Starbreeze Studios IT

**“BlueArc is able to handle the load we’re throwing at it with head room to spare. The number of IOPS that it was able to put out and the speed it could transfer data were basically unparalleled.”**

**We have yet to find a company that is putting out a product that can perform as well and for a sustained period as the BlueArc can.”**

Terry Dale, VP Operations,  
Starz Animation

**BlueArc NFS Storage: A No Compromise Solution for Medium to Large VMware Deployments**

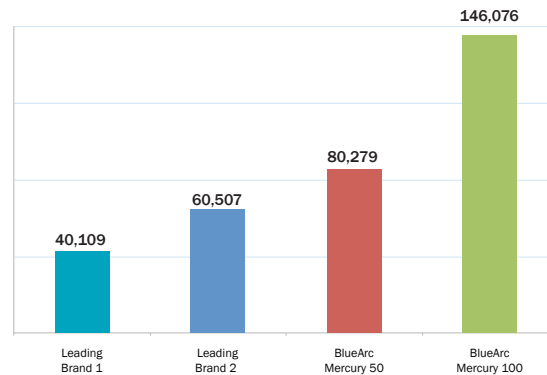
BlueArc storage delivers all the simplicity advantages of NAS, and does so with performance levels comparable to SAN. BlueArc NFS is the first storage solution that makes it possible to bring benefits of virtualization to a larger percentage of the data center. Stalled VMware projects in medium to large organizations can move ahead again; and with lower TCO.

**The Fastest NFS: BlueArc**

**Performance at Scale for Virtual Environments:** The secret to the BlueArc NFS system’s performance is SiliconFS.™ Unique in the marketplace for implementing a hardware-based file system that can process massive numbers of I/O commands in parallel, BlueArc has solved one of the thornier issues surrounding the adoption of VMware – the need for high performance storage with low complexity. Benefiting from the simplicity of NFS, BlueArc systems can support hundreds or thousands of virtual machines, as well as virtualized Tier-1 applications, without introducing performance bottlenecks. The hardware accelerated results speak for themselves.

- **Throughput with headroom:** BlueArc storage systems have enough headroom to deliver sustained performance in large VMware environments that experience mixed random and sequential I/O. The BlueArc storage is capable of handling the aggregated traffic of diverse workloads of enterprise applications hosted by VMs numbering in 100’s to 1000’s – each generating intensely random I/O for the storage system. BlueArc calls the ability to sustain peak level of I/O “Performance at Scale.”
- **Benchmarks scream on BlueArc:** In a recent set of published SPECsfs 2008\* results, using a benchmarking suite that measures random I/O performance, BlueArc storage systems IOPs exceeded those of the leading brand’s NAS solution.

SPECsfs IOPs of Midrange Storage Systems



- **QOS for individual VMs:** Since BlueArc’s NFS storage has visibility into file activity, and VMs are files, BlueArc can recognize which VMs are busy and, using policies defined by administrators, automatically move these VMs to storage that offers higher performance.

**Simplicity and Scale from BlueArc NFS Systems**

BlueArc provides all the simplicity advantages of NFS storage and goes several steps further. Using BlueArc’s JetCenter™ management interface within VMware vCenter, VMware administrators can provision storage to match the performance profile of applications without burdening storage administrators.

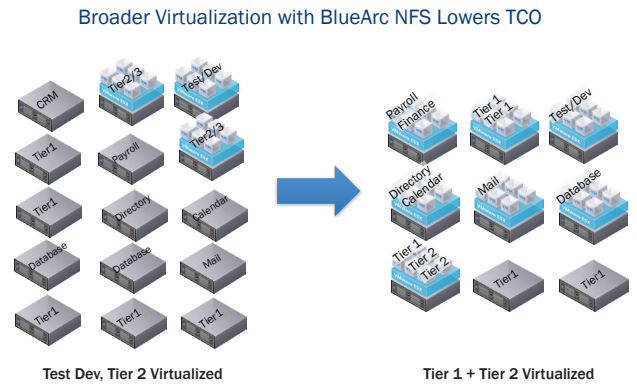
**Provisioning and Managing Storage is Simpler than SAN:** The manually intensive, multi-step process outlined earlier in the SAN section is replaced with a highly efficient, straightforward BlueArc provisioning process:

- Set up NFS datastore,
- Assign IP address to VMware vCenter,
- Use the Storage



**VMware administrators can easily Backup and Recover Virtual Environments with BlueArc:** Integrated with VMware vCenter, BlueArc JetCenter™ software presents a familiar interface for simplified management of backup and recovery operations for their virtual machines. JetCenter manages both VM quiescing and BlueArc NFS snapshots via an API and automatically ensures consistency between the VM and BlueArc snapshots. These snapshots can be used for both backup and recovery to VTL or tape, or can be replicated for business continuity.

**Scale without Pain:** Largest in the industry, the incredible capacity of the 256TB BlueArc file system makes room for many more VMs and very large VMs on a single volume. Whereas on a SAN, a large number of VMs might result in the need to provision multiple 2TB LUNs, BlueArc NFS storage allows administrators to manage a single storage volume that can scale, and grow. Further, BlueArc's Clustered Name Space scales to 16 petabytes, allowing virtualization administrators to manage a single, logical storage infrastructure. Making changes to storage is painless, requiring no downtime for your virtual machines. To add capacity, simply increase the size of the BlueArc volume and refresh storage in vCenter.



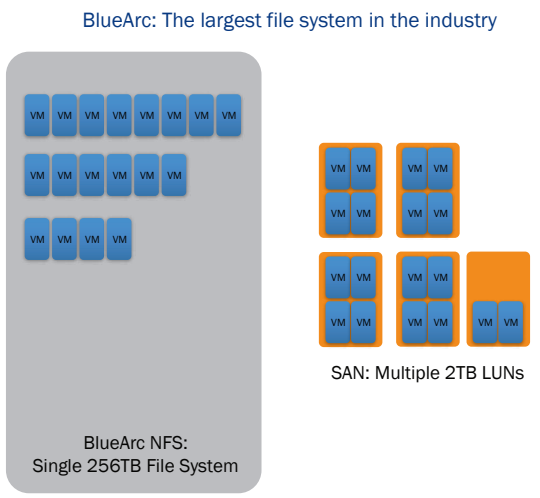
**“The current interest in adopting NFS for VMware is mostly driven by ease of management and existing skill set. For some users, using NFS has resulted in significant savings in both storage infrastructure and IT operations.**

**In another analysis, Gartner estimates that using NFS over Ethernet can reduce costs by \$3,500 per server over FC.”**

Tony Asaro, INI Group,  
Quoting Gartner Research  
in a recent report

**BlueArc Systems Dramatically Lower your Total Cost of Ownership:** There are two ways to lower cost in the virtualized data center. One is by increasing the percentage of virtualized servers, which VMware estimates will result in hardware and operational savings in the range of 50%. The other is by increasing efficiency and lowering the TCO of the storage layer itself. BlueArc NFS helps in both ways.

**Expanding VMware deployment without storage limitation:** As the only storage option to offer both the simplicity and the performance required by medium to large scale VMware environments, BlueArc storage helps IT managers realize the promise and TCO benefits of broader virtualization across the organization.





**Space efficient writable VMDK clones:** BlueArc JetClone™ with its “Writable Clones” feature, increases storage efficiency and lowers overall TCO. Using JetClone, enterprises create multiple copies or “clones” of single files by taking snapshots of that file and saving subsequent differences separately. By referring back to the original file for most of the data, JetClone avoids making multiple copies of the redundant elements of the file, optimizes the use of costly storage capacity, and speeds up the cloning process. Coupling the industry’s most space-efficient writable clones with a 256 terabyte file system (the industry’s largest) allows administrators to create an almost unlimited number of VM clones, maximizing the cost savings.

**Automated data migration to lower cost storage:** BlueArc can leverage a policy-based engine to intelligently migrate less frequently used data to lower cost storage optimizing cost and performance. BlueArc’s policy management applications use graphical, rule-based tools that simplify data management by minimizing the need for manual data migration, caching and replication. Administrators can create intelligent migration policies that trigger optimizations when specific levels or types of activity are detected.

### Conclusion

Restart your VM Engine and Lower your TCO with broader virtualization across a larger portion of your data center than ever before.

Today, many customers can attest to the fact that BlueArc NFS, offering the fastest NFS in the industry, delivers storage performance comparable to SAN. Now, managers can gain the simplicity of NFS, without compromising performance.

Join the list of global enterprises that depend on BlueArc technology to meet the storage needs of their high-performance computing environments. BlueArc delivers sustained performance that will meet the needs of the largest, most intense, virtualization deployments.

**“Since migrating our virtual machines onto BlueArc storage, we are able to do snapshots and restores 75% quicker than on our previous SAN infrastructure.**

**They have several server templates for installing and implementing new terminal servers. One example would be that on our previous SAN, they would take nearly 40 to 50 minutes to clone and deploy a machine from a template. On a BlueArc system, on the Titan, it’s 10 minutes at the most.”**

Giles Ogram,  
Senior Engineer, Helphire Group PLC



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