

## Breaking Down the Barriers to VDI with Dell EqualLogic iSCSI SAN Arrays

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While Taneja Group has been cautious to date on the pace of desktop virtualization adoption, recent hypervisor and storage technology innovations strongly suggest that in 2011 and 2012 we will see a rapid acceleration. Other contributing factors include strong enterprise confidence in compute and storage virtualization, the Windows 7 adoption cycle, an improving economic climate, and an increasingly mobile workforce.

Nearly 20% of CIOs report that desktop virtualization projects are underway, and we expect this to grow to 30% by mid-2011. It makes sense: desktop virtualization holds an even greater promise for both capital cost (CapEx) and operational expense (OpEx) savings than server virtualization, given the vast numbers of deployed desktop PCs and the steady flow of new flavors of mobile devices. Key to this momentum has been increased interest in one type of desktop virtualization, namely server-hosted virtual desktops (often called “virtual desktop infrastructure,” or VDI). VDI has often promised more than it delivered, however, due to complexity, performance and cost challenges.

Chief among these challenges has been the high up-front capital costs and subsequent inefficiencies of the storage platforms deployed to support VDI, which can quickly cut into VDI project ROI. Dell aims to turn this around, however, with several recent additions and enhancements to its popular EqualLogic PS Series iSCSI array family.

In this three-part report, we first review the current barriers to wider adoption of VDI, focusing on key storage challenges, and look at how Dell’s EqualLogic PS Series iSCSI SAN arrays, especially the new PS Series XVS hybrid SAS/SSD models, help customers overcome these problems. In Part 2, we will validate our claims via benchmark performance tests and from interviews with customers. In Part 3, we will test performance under additional deployment scenarios and dive deeper into the technology at the heart of the XVS hybrid arrays.

### Why Virtualize the Desktop?

Leveraging the experience and IT flexibility gained from server virtualization projects in the datacenter, an increasing number of companies are turning their sights on desktop virtualization.

The opportunity to lower the CapEx of the vast installed-based of desktop devices is compelling on its own, but the opportunity to lower OpEx by greatly simplifying desktop maintenance tasks—which are both time-intensive and expensive for IT—is even greater.

Extending virtualization to the desktop (or other end-point user device) is increasingly attractive to IT management. The desired goals we hear most frequently from Taneja Group clients are:

- Lower hardware costs and longer desktop hardware refresh cycles;
- Simpler, centralized software maintenance;
- Higher service levels for an increasingly mobile workforce;
- Better data and workspace security;
- Easier data protection and disaster recovery.

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**In short, the goal is to deliver great performance to any mobile worker, on any end-point device, while still maintaining control of the corporate workspace and critical data.**

While central control of a mobile workforce might seem contradictory, it is only by consolidating and standardizing on a manageable number of end-user environments—then serving them up on-demand and virtually—that IT can hope to keep up with the current rate of growth in devices, applications and data, security threats *and* user demands.

### **VDI Today: Delivering Proven Benefits**

Each desktop virtualization project will be unique, potentially mixing thick and thin clients, application streaming and/or terminal services, client hypervisors and VDI (server-hosted) desktops, depending on an organization's existing desktop infrastructure, expertise, and objectives. We focus here on VDI due to its potential for significant enterprise ROI, its maturity, and its increasing popularity among virtualization-savvy enterprises of all sizes. VDI has been proven to help companies:

#### **Utilize Existing IT Resources More Effectively and Efficiently**

Consolidation of user environments into a central location (such as a datacenter or cloud provider) allows IT to deliver the right environment to a user independent of desktop hardware platform. Companies can repurpose devices as needed and leverage less expensive thin clients. As required, user environments can be optimized centrally and accessed via a variety of different devices, reducing over-provisioning and the need to support aging and/or outdated hardware longer than desired. In the datacenter, virtual desktops can be storage-optimized by deploying thin provisioning and cloning technologies, reducing unused disk space across a large pool of physical desktops.

#### **Streamline Desktop Operations to Save Both Time and Money**

Once they are consolidated, virtual desktops offer IT management significant opportunities for operational efficiency. A limited number of approved, “gold” configurations can be created and their use enforced, reducing provisioning time and reducing the chance for errors or security problems.

Maintenance (patches, upgrades, updates) can be scheduled when most convenient for IT, and applied to a master “gold” image rather than being pushed to and tested on a variety of desktop devices, which often consumes the bulk of desktop support staff time.

IT can also move user workloads to different servers during spikes in demand, stagger or speed up desktop refreshes, and isolate OS and user data from one another. Together, these options increase IT's flexibility and agility and can reduce desktop OpEx significantly.

#### **Smooth the Transition to New Operating Systems and Desktop Devices**

The primary goal of end-user technology must be higher productivity. To that end, users themselves continually seek to leverage the latest OS enhancements, PC hardware advances, and new mobile devices. IT must be nimble and responsive to satisfy this demand while retaining control and adequate service levels.

In particular, the move to Windows 7 has also caused many IT departments to take a closer look at desktop virtualization. A large population of aging desktops based on Windows XP (many up to seven years old now, since many companies skipped a Vista upgrade) can be expensive and risky to upgrade. Instead, many IT departments are encapsulating older applications in virtual appliances, streaming both older and new applications to thin clients, and/or deploying server-hosted virtual desktops from a centrally managed pool of Win 7 images.

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Similarly, new smartphones, netbooks, tablets and other mobile devices gain followers quickly, and these highly mobile ‘warriors’ expect their corporate data and applications to be available as soon as they establish a network connection. Virtualized environments help IT to be ready when users are, wherever they are.

**Improve Data Protection and Tighten Security for Sensitive Data**

Virtual desktops can also be duplicated, moved and backed up as often as needed—on the IT department’s schedule instead of the user’s, bringing data protection and compliance back under the control of IT. User environments can be refreshed on every logout, enforcing configuration standards and keeping sensitive data under IT control. Overall, centrally-managed user environments leave less opportunity for users to create problems via locally installed data or malicious applications, lowering compliance risks.

**VDI: The Bottom Line**

Over the life of a PC, the cost of managing, patching, upgrading, and diagnosing problems can easily grow to five times the initial cost of the machine. These operating costs can vary dramatically (and unpredictably) over time, due to typical IT events such as OS upgrades, hardware refreshes, or the integration of new users via a merger or acquisition (Fig. 1). In most cases, support costs increase linearly with the number of physical desktops and mobile devices.

VDI, on the other hand, can effectively lower and smooth out ongoing desktop support costs via the economies of scale gained from normalization, optimization, and consolidation. However, VDI does require a significant up-front investment in virtual servers and storage, slowing or derailing many projects. Compounding the problem, VDI has suffered from poor user experience, a lack of mature management tools, and storage performance issues.

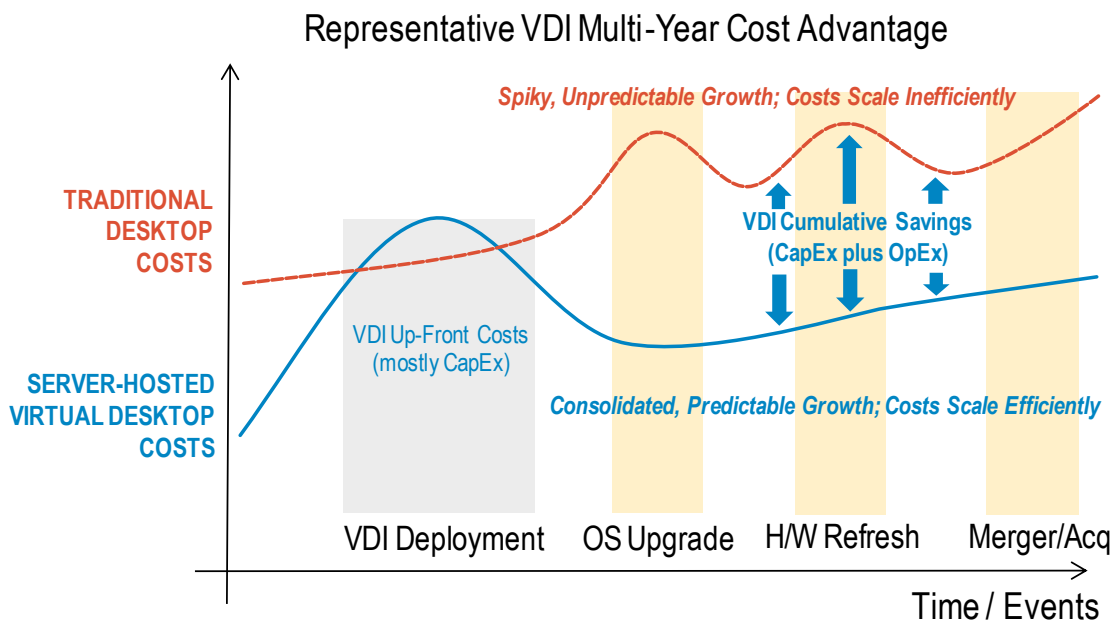


Figure 1: VDI offers predictable support costs that scale efficiently

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**VDI Platform and Protocol Enhancements Help Performance**

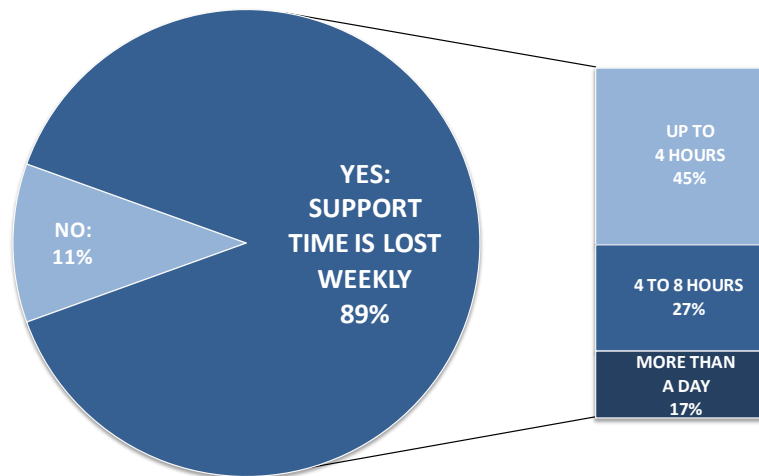
Since these first-generation VDI projects were undertaken, however, many of the trickier user experience issues have been addressed by improvements in remote display protocols, such as PCoIP (VMware) and HDX (Citrix).

VDI vendors have also introduced powerful desktop image management tools such as VMware’s View Composer, which greatly simplifies provisioning and maintenance for

large populations of virtual desktops. These performance and management advances at the display and hypervisor layers have certainly improved the ROI for VDI projects, but on their own have not gone far enough.

Indeed, in a recent Taneja Group survey, 89% of datacenter managers reported that their administrators are wasting time due to immature and/or overly complex virtualization management tools. Of those, nearly one in five estimated the impact do be more than a day per week per administrator (Fig. 2).

**Does Virtual Infrastructure Management Complexity Waste Administrator Time? If so, how much?**



*Figure 2: VDI offers predictable support costs that scale efficiently*

**But VDI Storage Challenges Persist**

Storage is at the heart of the VDI ROI equation. Successful companies must minimize **both** the up-front capital costs as well as the on-going operational expenses of VDI storage in order to realize high enough returns. In our view, the storage challenge poses the highest barrier to wider VDI adoption.

The VDI platform vendors have introduced storage layer technologies to help overcome the high capacity requirements of server-hosted virtual desktops. VMware’s Linked Clones, to cite the most elegant and advanced of these technologies, can significantly reduce the desktop image storage footprint for many VDI use cases. Again, this is only part of the answer.

## S O L U T I O N P R O F I L E

Early adopters of VDI have struggled not only with high capacity requirements, but with spiky and variable I/O that creates performance bottlenecks at high VM densities. In our discussions with these customers, we hear the following feedback most often:

### **“VDI Storage is too Difficult to Manage and Control”**

Provisioning of new desktop images has been typically managed via the virtualization layer, and can be a time-consuming, multi-step process which becomes overwhelming at scale. Patches and updates must still be applied to every desktop VM, and while this is easier in a VDI environment than it was with remote PCs, the tools for automating and validating maintenance procedures are only now maturing.

Snapshots and backups are also typically driven from the virtualization host’s management interface, introducing yet another tool which may or may not take advantage of existing array data protection capabilities.

### **“VDI Performance Demands are too Complex and Variable”**

VDI storage environments have challenging performance profiles: multiple user types, running varying workloads, requiring different IOPS, all hitting the same shared disks. This can dramatically alter the read/write (r/w) ratios that array cache algorithms expect, and reduce cache effectiveness unless common data (shared OS images, for example) are utilized.

Also, hundreds of users typically log in at virtually the same time, causing a “boot storm” that can bring an array to its knees. In fact, IOPS and r/w ratios vary significantly during the work day in a typical VDI deployment: from very high r/w ratios during boot storms to the opposite during intense periods of user activity.

### **“VDI Storage is too Expensive”**

Earlier VDI solutions were often built around a full desktop VM image for each user, making it difficult to justify replacing hundreds or thousands of relatively cheap desktop drives with expensive enterprise SAN arrays. While capacity requirements can be reduced somewhat by using Linked Clones to shrink image footprints, most leading SAN array architectures simply do not scale up or out cost-efficiently—adding incremental capacity is often prohibitively expensive, disruptive, and time consuming. On top of this, most vendors charge dearly for add-on snapshot, remote replication, and other data protection and management software.

**In order for VDI to be economically viable, the underlying storage platform must support desktop VM densities much higher than those required for effective server virtualization.**

**This requires not only a highly adaptable, low-latency architecture, but powerful management automation and intelligence to rein in operating expenses.**

### **Overcoming the VDI Storage Problem**

Storage that doesn’t **complement** the virtual infrastructure will **complicate** it. To this end, storage architecture matters. In Taneja Group’s view, if you are about to begin (or expand) a VDI effort, you should take the challenges outlined above seriously when evaluating storage platforms.

Does the vendor recognize the problems and have they moved quickly to get out in front of them? Do the vendor solutions show thought leadership and innovative thinking?

We recommend you look for the following solution features:

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Storage Challenge	Essential VDI Storage Solution Features
<b>The Complexity Problem</b>	<ul style="list-style-type: none"> <li>• Simplified set up, provisioning, and data protection operations</li> <li>• Comprehensive management and monitoring tools and interfaces</li> <li>• Transparent storage resource sharing across disks and arrays</li> <li>• Seamless integration with hypervisor vendor’s management framework</li> </ul>
<b>The Performance Problem</b>	<ul style="list-style-type: none"> <li>• Automated load balancing across arrays, controllers, disks, etc.</li> <li>• Flexible and broad range of disk types and speeds available</li> <li>• Intelligent tiering for varying I/O performance requirements</li> <li>• Deep integration with hypervisor-layer storage APIs and optimizations</li> </ul>
<b>The Value Problem</b>	<ul style="list-style-type: none"> <li>• Modular architecture with elastic scale-up and scale-out</li> <li>• Leverages lower-cost storage networking protocols such as iSCSI</li> <li>• Includes management tools to keep storage software and maintenance charges low</li> </ul>

### Dell EqualLogic PS Series iSCSI Arrays

With these essentials in mind, we’ve taken a close look at Dell’s EqualLogic PS Series iSCSI SAN arrays, designed from the ground up to be simpler, more flexible, and more cost-efficient than legacy SAN architectures.

These design goals have made the PS Series a first choice for enterprise IT consolidation and virtualization. Packaged in an all-inclusive model at an affordable price compared to competitive offerings, the PS Series delivers pay-as-you-grow scalability, powerful management tools, self-optimized performance, fully redundant hot-swappable hardware, and a broad set of features targeted specifically at virtual environments—and at VMware-based VDI deployments in particular.

#### Automated Data Protection

All PS Series arrays include auto-replication, instant volume restore, multi-volume writeable snapshots and volume cloning. A scheduler is included to automate snapshot and replication operations.

Dell’s Auto-Snapshot Manager/VMware Edition (ASM/VE) is another innovative data protection feature of the PS Series family; it integrates VMware vSphere’s Data Recovery and Snapshot functionality for fast, online protection of both VMs and VMFS file systems.

ASM/VE provides an easy-to-use GUI that coordinates the creation, recovery and scheduling of PS Series snapshots, clones, and replicas with vCenter Server, enhancing VM protection, storage utilization, and performance.

#### Cost-Efficient Scale-up and Scale-out

EqualLogic PS Series arrays are built on a patented, *peer storage* architecture. Each shelf of disks functions as a self-sufficient entity, including its own controllers, cache, bandwidth, multiple power supplies and RAID protection.

Multiple such storage entities are joined together as peers, creating a single, logical pool of storage. Pool members dynamically share resources, redistribute workloads, and work together to optimize application performance.

## SOLUTION PROFILE

The PS Series architecture simplifies both scale-up and scale-out strategies, and is highly elastic: as new disks or shelves are added to an array, that capacity is absorbed into the pool and immediately shared. When a new array is added, data is automatically and transparently load balanced across the pool, among both different storage types and RAID levels, automating tiering.

### Lower Capacity Requirements and Costs

Additional options help minimize the cost of VDI storage as administrators scale their deployments. For example, thin provisioning on the PS Series allows over-provisioning of storage to help reduce costs during rollout; new arrays can be added non-disruptively as users consume disk space, allowing cost-effective, just-in-time, linear growth.

Also, leveraging VMware View Composer's Linked Clone technology helps to increase storage efficiency and dramatically simplify virtual desktop provisioning and management. By managing user-unique virtual desktop data separately from common data, View Composer efficiently integrates storage deduplication.

### Simplified Storage Provisioning, Monitoring and Management

Administrators can dynamically provision all storage resources—including disk space, thin-provisioned volumes, connectivity, data protection and performance—to meet evolving application needs, without downtime. Automated installation and no-cost SAN monitoring software complete the package. As an array is brought up, built-in intelligence senses the network topology automatically to eliminate cumbersome configuration tasks; an enterprise-class SAN can often be deployed in minutes.

Dell also includes its SAN Headquarters (SAN HQ) storage monitoring software with every PS Series array. SAN HQ includes intuitive charts and reports detailing the health status of PS

Series groups, members, network and disks. Administrators can identify I/O bottlenecks faster, correlate them to events in the virtual server infrastructure, and develop better remediation strategies. SAN HQ provides enterprise-class storage monitoring without in-house scripting or the need to license third-party add-on software—again, saving both time and money.

### Comprehensive Integration with VMware's Platforms, Tools, and APIs

Dell has invested heavily in deep integration with VMware, and continues to be a storage platform of choice for savvy VMware customers. Integration highlights include:

*VMware vStorage APIs for Array Integration (VAAI)* is an ongoing technology initiative that provides new enhancements for intelligent SAN integration with vSphere and the VMware vStorage APIs. The vStorage API's base functionality enables virtualized storage and centralized management, while vStorage VMFS provides file system services that enhance performance of virtualized storage in VMware environments.

*VM deployments can be achieved 72% faster with EqualLogic and vSphere 4.1—a significant productivity increase.*

EqualLogic PS Series arrays leverage VMware vSphere and the VMware vStorage API's to help provide more efficient, integrated data services.

The *VMware vCenter Site Recovery Manager (SRM) Storage Adapter* is tightly integrated with Dell EqualLogic PS Series and VMware vCenter Server. SRM guides users through the process of setting up and configuring recovery plans for their virtualized IT environment.

Additionally, SRM provides the functionality to test these recovery plans with no impact to production environments and at the time of failover, automatically run the recovery plan—

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starting virtual machines in the proper order with updated networking configurations. Using the PS Series' native Auto-Replication feature, SRM enables non-disruptive, automated testing of recovery plans and automates the recovery process, while the PS Series provides cost-effective and easy-to-configure replication over any distance using existing IP networks.

Through integration with *VMware's vStorage APIs for Multipathing*, Dell delivers improved VDI performance and scalability through advanced features such as fault-tolerant load balancing and intelligent management of multiple network connections.

Basic multi-pathing software provides multiple redundant network connections to a PS Series array, removing a single point of failure from the storage network.

Advanced multipathing extends this functionality beyond simple fault tolerance and provides storage-aware, end-to-end management of the data path between the host and storage.

Dell's *Multipath Extension Module for VMware vSphere* introduces additional advanced capabilities such as automatic connection load-balancing without any additional configuration.

### **Intelligent Data Placement for Multi-Tiered Workloads**

Intelligent data placement and ongoing optimization—a standard feature across the PS Series—is fully automated to deliver the best possible performance in mixed-workload environments, such as VDI. This intelligent tiering enables IT administrators to leverage high-performance SAS arrays for VDI, for example, while leveraging economical SATA disks for applications less sensitive to performance such as file shares.

Going a step further, Dell recently introduced the **EqualLogic PS Series XVS hybrid SSD/SAS** array, which delivers tiered storage in a *single* array. The PS6000XVS (and its 10GbE counterpart, the PS6010XVS) includes eight 100GB SSD drives and eight 450GB 15K SAS drives, for a total of 4.4TB raw capacity. The PS Series XVS arrays are aimed squarely at multi-tiered workloads such as those found in large-scale VDI, where many users share the same base image (boot OS source or core).

EqualLogic's intelligent software automatically places the base image on the low-latency, high-performance SSD tier to ensure maximum throughput, while temporary data as well as users' unique application data is placed on lower cost, capacity-optimized SAS drives.



## Taneja Group Opinion

In our view, the EqualLogic PS Series XVS hybrid array is a significant turning point for VDI adoption. It's nearly impossible to accurately predict exactly when and how boot storms might occur, or how quickly user data will grow in a virtualized desktop environment, and these planning and sizing concerns have made VDI seem more trouble than it's worth for many—or at least made it more difficult for IT management to justify VDI as a strategy with confidence.

The EqualLogic PS Series XVS is **built** to simplify VDI: with SSD for high-IOPS access to common desktop image data, high-capacity SAS for large user data drives, and on-board automated tiering to strike the optimal balance between the two. And, like all modular EqualLogic PS Series iSCSI arrays, it scales out elastically, scales up efficiently, and comes complete with a full range of automation features. Tackling uncontrolled capacity demands and unpredictable boot performance, the PS Series XVS works continuously to drive up storage utilization, drive down response times, and keep growth costs in check.

We expect the PS Series XVS to deliver a higher return for every VDI storage dollar spent than earlier-generation virtualized storage platforms. In addition, Dell's commitment to deep integration with the VMware vSphere and View products and APIs ensures that customers will enjoy the highest levels of performance and manageability at every layer of their VMware-based VDI deployments.

If you've shied away from VDI in the past, particularly due to storage concerns, we encourage you to take a fresh look. With EqualLogic storage powering your virtual desktops, we are confident your multi-year ROI for VDI versus traditional desktop infrastructure will look much more attractive than it did just a few years ago.

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